



An Coimisiún um
Rialáil Cumarsáide
Commission for
Communications Regulation

Proposed Multi Band Spectrum Award - Response to Consultation and Draft Decision

The 700 MHz Duplex, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands

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Response to consultation and draft Decision

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An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation

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Overview of Key Proposals

1. The Commission for Communications Regulation (ComReg) is the manager of the radio spectrum in Ireland. An important part of this function is to assign spectrum rights of use for electronic communications services (ECS) in a manner that furthers ComReg's statutory objectives including, promoting effective competition, promoting the interests of users, and ensuring the effective management and efficient use of spectrum in Ireland.
2. This document sets out ComReg's response to Consultation Document 19/59R and draft decision on its detailed proposals for a multi-band spectrum award to assign long-term rights of use in four spectrum bands all of which are suitable for mobile and wireless broadband (WBB) services¹ ("Proposed Award"). These spectrum bands are the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz bands², which are harmonised at European level for the provision of WBB services.
3. In total, ComReg proposes to award 470 MHz of harmonised spectrum rights, which would represent a 46% increase in the harmonised spectrum assigned for the provision of WBB services in Ireland and would significantly enable the market to provide improved services to meet increasing consumer demand for mobile data and new services.
4. In line with its obligation to promote competition, ComReg proposes to award rights to these bands by way of an open, competitive award process where existing operators and potential new entrants can compete for these spectrum rights. Further, and in line with European obligations, ComReg proposes to award the spectrum rights on a technology and service neutral basis, meaning that new licensees would be free to deploy equipment that complies with the applicable harmonised standards, for mobile, fixed wireless and/or other uses. Without limiting the uses to which the rights of use of spectrum may be put, ComReg would expect this award to be particularly suitable for enabling advancements in current 4G services and the delivery of new 5G services.

¹ This document also sets out ComReg's response to ComReg Document 19/59R, having had regard to the views received from interested parties, recent developments and other relevant material.

² The 700 MHz band (703-733 / 758- 788 MHz);
The 2.1 GHz band (1920-1980 / 2110 – 2170 MHz);
The 2.3 GHz band (2300 -2400 MHz); and
The 2.6 GHz band (2500 -2690 MHz).

Proposals for the 700 MHz band

5. In Ireland, the 700 MHz band is currently used for Digital Terrestrial Television (DTT). As outlined in Ireland's National Roadmap on the use of the 700 MHz Frequency Band, published by the Department of Communications, Climate Action and Environment (DCCA), work to migrate DTT services from the 700 MHz band is being carried out by 2RN, which operates RTÉ's DTT transmission network, and DTT services will cease operation in the 700 MHz band in 2020³.
6. Given its favourable radio propagation characteristics, the 700 MHz band is a particularly important band for the provision of widespread coverage, including in rural areas and on national transport routes. The 700 MHz band has also been identified as a 5G "pioneer band" for Europe.
7. Noting this importance, and having regard to European obligations concerning this band⁴, ComReg's proposals include making available the entire 60 MHz (i.e. 2x30 MHz) in the duplex portion of this band for award ("700 MHz Duplex").
8. In considering coverage obligations for the 700 MHz Duplex, ComReg has considered various options, including the use of 'precautionary' and 'interventionist' coverage obligations⁵, where:
 - 'precautionary' coverage obligations refer to obligations which would not exceed the levels of coverage that might be expected anyway from well-functioning competition between network operators; and
 - 'interventionist' coverage obligations refer to obligations that can be expected to constrain the commercial choices of network operators and force coverage in excess of competitively-determined levels.
9. As outlined in its draft Regulatory Impact Assessment (RIA) of the various options, ComReg's proposed approach is to set coverage obligations which are precautionary in nature, and towards the upper end of the range of commercially-realistic competitive outcomes. Among other things, this would promote and safeguard competition in the award process, thereby underpinning the role of competition in driving coverage, and also avoid outcomes where spectrum rights could be unassigned because the coverage obligation was considered excessive.

³ <https://www.dcca.gov.ie/documents/700MHz%20Roadmap.pdf>

⁴ EC Decision 2016/687 and EU Decision 2017/899.

⁵ See further in ComReg Document 18/103d.

10. ComReg's proposed coverage obligations for the 700 MHz Duplex would be required to be achieved over a period of 3 to 7 years and, among other things, would oblige existing licensees⁶ to expand their current networks to provide and maintain⁷:
- a 3 Mbit/s service to 99% of the population and 92% of the geographic area of Ireland;
 - a 30 Mbit/s service to 95% of the population, 90% of motorways, and 80% of primary roads; and
 - a 30 Mbit/s service to 345 specific locations⁸, consisting of 40 business and technology parks (including "strategic sites"), 65 hospitals, 24 higher education campuses, 14 air and sea ports, 160 train and bus stations, and 42 top visitor attraction information points.
11. ComReg is also proposing other obligations to improve indoor voice and text coverage and quality of service. These obligations would oblige licensees to deploy and maintain Voice over LTE (VoLTE)⁹ and Native Wi-Fi¹⁰ technologies, under certain conditions, on their networks within 2 years.
12. In relation to 'interventionist' coverage obligations, and having had regard to, among other things, the limited submissions received in support of such a mechanism in the Proposed Award, the views of its expert advisors and mindful of the timing obligations and clear benefits of a prompt award of rights of use in the 700 MHz Duplex (along with the spectrum efficiency and related consumer benefits from the earlier award of rights of use in the other spectrum bands), ComReg intends to advance the Proposed Award targeting the imposition of precautionary coverage and other obligations as outlined above.

⁶ ComReg proposes to impose different obligations on FWA operators and new entrants.

⁷ The 3 Mbit/s and 30 Mbit/s services identified in these coverage obligation proposals refer to single user throughput services at the cell edge

⁸ In considering these specific locations ComReg has had regard to the output of the Mobile Phone and Broadband Taskforce which provided a guidance [report](#) on the broad categories of locations where mobile services should be available. Based on a ranking of the benefits (economic, societal, safety) of different location categories, it provides the following conclusions:

- 1) *There is a clear emphasis on the provision of mobile phone coverage at locations where large numbers of people work or spend typical working hours. It should be noted that often people do not live where they work.*
- 2) *Residential locations and locations where people pass their free time were the next most important type of location.*
- 3) *Quiet roads, rail lines, cycleways, walking routes and locations where low numbers of people work were considered the lowest priority for mobile phone coverage.*

⁹ Voice over LTE (VoLTE) is a managed voice service that benefits from prioritisation over other traffic.

¹⁰ With native Wi-Fi calling, calls and texts on a smartphone, rather than going through the mobile network directly, instead use the available Wi-Fi connection. Native Wi-Fi is particularly relevant for Ireland given the challenges in providing mobile connectivity to all premises and the use of modern building materials which can significantly impair the availability of radio signals indoors. The advent of the National Broadband Plan seems likely to increase its ability even further.

13. ComReg nevertheless remains prepared to assist the State in any subsequent step it may wish to pursue by which to procure coverage outcomes beyond market-driven levels, noting the advantages of a separate step previously identified by ComReg including:
- seeing what the proposed precautionary obligations and competition between operators would first deliver; and
 - thereby better ensuring that the societal benefits obtained from any intervention exceed the costs of imposing same.

Proposals for the 2.1 GHz, 2.3 GHz and 2.6 GHz bands

14. The remaining spectrum bands proposed for award are more suited to providing network capacity, if used for mobile, although they could also be used for both capacity and coverage purposes (such as for fixed wireless broadband). ComReg's proposals for these bands are outlined below.

2.1 GHz band proposals

15. In Ireland, the 2.1 GHz band is currently used to provide 3G services and existing licences in this band run until 2022 and 2027¹¹.
16. ComReg's proposals for the 2.1 GHz band include:
- awarding new rights in two "time slices", consisting of 90 MHz (2x45 MHz) in time slice 1¹², and 120 MHz (2x60 MHz) in time slice 2;
 - aligning the expiry dates of the existing 3G licences expiring in 2022 to 15 October 2022 to enable a single commencement date for time slice 1 in the 2.1 GHz band;
 - facilitating the "liberalisation" of all existing 3G rights so as to enable the deployment of 4G and other technologies;
 - a coverage obligation to deploy a specific number of base stations in the band in order to ensure the efficient use of spectrum; and
 - a process to ensure the orderly and timely transition from existing rights to new rights of use.

¹¹ 2022 for Vodafone and Three, and 2027 for Eir.

¹² Time slice 1 runs to 11 March 2027 to align with the expiry of Eir's existing 3G licence. Time slice 2 commences on 12 March 2027.

Potential for early surrender of 3G licences in the 2.1 GHz Band

17. From submissions to this consultation process, ComReg observes that some or all of the existing licensees in the 2.1 GHz Band may wish to surrender their 3G licences early in order to streamline the award process without compromising its effectiveness.
18. While these are matters for the existing licensees to consider, ComReg would assess any proposals submitted on its merits.
19. Parties, whether all existing licensees, or Three and Vodafone only, should jointly notify ComReg of any intention to surrender 2.1 GHz rights of use and provide a binding commitment from each licensee that, singularly and combined, addresses the timing issue and certainty issue on the surrender of such rights of use, including the time period over which such a surrender would occur (i.e. a common start date by which newly assigned spectrum rights of use in the 2.1 GHz band would commence). In that regard, ComReg would remind all licensees of their obligations under competition law and, in particular, Sections 4 and 5 of the Competition Act 2002.
20. In order to consider any proposals received from licensees and give effect to same in a timely manner, ComReg would need to receive same by no later than the closing date for submissions to this consultation (i.e. by 12 noon on 10 February 2020).

2.3 GHz band proposals

21. The 2.3 GHz band is widely used for WBB globally, particularly in the Asia Pacific region. In Ireland, this band is unassigned, except for a small portion (2307 MHz – 2327 MHz) which is currently licensed to Eir for its RurTel network which it uses to provide universal service obligation (USO) services at a small number of locations in the Donegal and Galway regions.
22. ComReg's proposals for the 2.3 GHz band include:
 - making available 100 MHz of spectrum for award;
 - awarding new rights in two time slices, corresponding to the two time slices proposed for the 2.1 GHz band;
 - a coverage obligation to deploy a specific number of base stations in the band in order to ensure the efficient use of spectrum; and
 - transitional measures to facilitate the continued provision of Eir's RurTel USO services until alternative services become available (whether from Eir or another provider, for example, on foot of the Government's National Broadband Plan).

2.6 GHz Band proposals

23. The 2.6 GHz Band is widely used for WBB in Europe and globally. In Ireland, this band is unassigned following the expiry of multichannel multipoint distribution system (MMDS) licences in 2016.

24. ComReg's proposals for the 2.6 GHz Band include:

- making available 190 MHz (2x70 MHz FDD and 50 MHz TDD) of spectrum for award;
- awarding new rights in two time slices, corresponding to the two time slices proposed for the 2.1 GHz Band;
- a coverage obligation to deploy a specific number of base stations in the band in order to ensure the efficient use of spectrum; and
- engaging with stakeholders to address co-existence of new services with aeronautical radars operating above the 2.6 GHz Band.

Other key aspects of the proposed award

25. The consultation also sets out ComReg's proposals on other key aspects of the Proposed Award, including:

- licence duration: a proposed duration of 20 years for rights in the 700 MHz, 2.3 GHz and 2.6 GHz Bands, with a corresponding shorter duration for the 2.1 GHz band to facilitate a common expiry date for all the bands in the Proposed Award;
- award type and format: an open, competitive award format based on a combinatorial clock auction (CCA). While ComReg has used a variety of award formats in recent years, this award format has previously been used in Ireland for the successful award of spectrum rights in the 800 MHz, 900 MHz and 1800 MHz Bands in 2012, and spectrum rights in the 3.6 GHz Band in 2017;
- spectrum fees: proposed spectrum fees (i.e. auction reserve prices and ongoing spectrum usage fees) which would be set at a conservative level based on a benchmarking methodology. This approach would encourage competition in the Proposed Award while also discouraging frivolous bidders and, similar to previous spectrum awards, would mean that final prices would ultimately be determined by the bidders in the proposed auction and not ComReg;
- spectrum competition caps: two sets of spectrum competition caps - one of 70 MHz for sub-1 GHz spectrum, and another of 375 MHz for total

spectrum holdings - to promote and safeguard competition by preventing extreme asymmetric outcomes in the Proposed Award that would be detrimental to competition.

Next Steps

26. ComReg invites views from interested parties on all aspects of the Proposed Award over the next 7 weeks and by 12 noon on 10 February 2020. Recognising that this consultation spans the Christmas period and that the mobilisation of resources may be challenging during this time, ComReg has given an additional three weeks over the normal four weeks identified in ComReg's Consultation Procedures¹³.
27. ComReg intends to publish in the spring of 2020 a draft Information Memorandum outlining in detail the processes and procedures it currently envisages employing when implementing its spectrum award proposals as referred to in this draft decision. Interested parties will be invited to comment on that draft Information Memorandum when it is published.
28. Following receipt and consideration of submissions in response to this document, and other relevant material, including the above draft Information Memorandum, ComReg intends to publish a response to consultation and final decision for the Proposed Award.

¹³ See [ComReg Document 11/34](#)

Chapter 1

1 Introduction

1.1 In Document 19/59R¹⁴, ComReg set out its detailed proposals for a multi-band spectrum award to assign rights of use in four spectrum bands which are suitable for wireless broadband (“WBB”) including mobile services (the “Proposed Award”). These spectrum bands are the 700 MHz Duplex, 2.1 GHz, 2.3 GHz and the 2.6 GHz Bands, all of which are harmonised at a European level for the provision of WBB services.

1.2 Eleven responses were received to Document 19/59R, being from:

- Dense Air Ireland Ltd (“Dense Air”);
- Eircom Ltd (“Eir”);
- Ericsson Ireland (“Ericsson”);
- Imagine Communications Group Ltd (“Imagine”);
- Mr. Liam Young;
- Motorola Solutions (“Motorola”);
- MVNO Europe;
- Three Ireland Hutchison Ltd (“Three”);
- Virgin Media Ireland Ltd (“Virgin Media”);
- Vodafone Ireland Ltd (Vodafone); and
- A confidential respondent.

1.3 ComReg is grateful for these responses.

¹⁴ Document 19/59R, “Proposed Multi Band Spectrum Award – including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands”, published 18 June 2019.

This document

1.4 This document sets out:

- firstly, ComReg's response to Consultation Document 19/59R, having regard to the views received from interested parties¹⁵, recent developments and other relevant material, and
- secondly, a further consultation on its detailed proposals for the Proposed Award and accompanying draft Decision.

1.5 In arriving at the proposals set out in this document, ComReg has had regard to the statutory powers, functions, objectives and duties relevant to its management of the radio frequency spectrum (the most relevant of which are summarised in Annex 2). ComReg has also had regard to various European decision documents harmonising the frequency assignments and technical conditions for the availability and efficient use of the spectrum bands proposed for inclusion in the award process (see Annex 4), the responses to Document 18/60, its most recent Radio Spectrum Management Strategy Statement¹⁶ and its electronic communications services strategy.¹⁷

1.6 ComReg is publishing alongside this document:

- an analysis prepared by ComReg's economic and award design expert, DotEcon Limited ("DotEcon"), of submissions received in response to Document 19/59R relating to the award design and format (published separately as Document 19/124a);
- an analysis prepared by DotEcon, of submissions received in response to Document 19/59R that relate to the discussion of coverage obligations therein and the Spectrum Awards Report (Document 18/103d) (published separately as Document 19/124b);
- an analysis prepared by ComReg's technical expert, Plum Consulting London LLP ("Plum"), of submissions received in response to Document 19/59R relating to matters of a spectrum engineering nature and addressing updated information relating to same (published separately as Document 19/124c);

¹⁵ ComReg Document 19/124g

¹⁶ Document [18/118](#), "Radio Spectrum Management Strategy Statement 2019 to 2021", published 20 December 2018.

¹⁷ Document [19/09](#), "Strategy Statement 2019 – 2021: Public Consultation on Mid-term review of ComReg's Five Year ECS Strategy", published on 25 February 2019.

- a report by Plum setting out the results of compatibility testing between the air traffic control radars at Shannon airport and future Mobile/Fixed Communications Networks (“MFCN”) deployments (published separately as Document 19/124d);
- an analysis prepared LS telcom UK Ltd (“LS Telecom”), of submissions received in response to Document 19/59R relating to spectrum management options for Terrestrial Broadband Public Protection and Disaster Relief (“BB-PPDR”) (published separately as Document 19/124e); and
- an analysis prepared by Oxera Consulting LLP, with Real Wireless Ltd, of submissions received in response to Document 19/59R that relate to the Future Mobile Connectivity Report (Document 18/103c) (published separately as Document 19/124f).

Structure of this document

1.7 This document is structured as follows:

- **Chapter 2:** sets out some background information relevant to this consultation process and considers at a high level related responses received to Document 19/59R in relation to same;
- **Chapter 3:** considers the responses received relating to which spectrum bands to include in the Proposed Award and on the corresponding draft regulatory impact assessment (“RIA”) (the ‘Spectrum for Award’ RIA). In addition, this chapter considers the responses received relating to the draft RIA which addressed the type of award process that should be used (the ‘Assignment Process’ RIA).
- **Chapter 4:** sets out ComReg’s proposals and consideration of relevant submissions relating to the 2.1 GHz Band, including regarding the liberalisation of existing rights of use in the band and a mechanism for addressing the different expiry dates of existing licences in this band;
- **Chapter 5:** sets out ComReg’s proposals and consideration of relevant submissions relating to key aspects of the Proposed Award, including the band plans and licence duration;
- **Chapter 6:** sets out ComReg’s proposals and consideration of relevant submissions on the details of the Proposed Award itself, including the award type, licence fees and spectrum competition caps;
- **Chapter 7:** sets out ComReg’s proposals and consideration of relevant submissions regarding the conditions to be attached to rights of use on

foot of the Proposed Award, including conditions relating to coverage and rollout, quality of service, service- and technology-neutrality, and technical conditions related to synchronisation and coexistence;

- **Chapter 8:** sets out ComReg's proposals and consideration of relevant submissions in relation to transition issues that may arise as a consequence of the outcome of Proposed Award;
- **Chapter 9:** sets out ComReg's draft Decision regarding the Proposed Award;
- **Chapter 10:** details how to submit comments in response to this document and the envisaged next steps in this process;
- **Annex 1:** includes a glossary of terms;
- **Annex 2:** summarises ComReg's statutory functions, objectives and duties relevant to the management of Ireland's radio frequency spectrum;
- **Annex 3:** sets out ComReg's consideration of submissions received in relation to the connectivity reports published alongside Document 18/103;
- **Annex 4:** provides updated information on equipment availability, award status in Europe, harmonisation decisions and spectrum availability for the spectrum bands considered in Document 19/59R;
- **Annex 5:** sets out ComReg's proposals and consideration of relevant submissions related to its assessment of the spectrum options for BB-PPDR in the context of the 700 MHz Band;
- **Annex 6:** sets out ComReg's updated draft 'Spectrum for Award' RIA and 'Assignment Process' RIA, taking into account updated information and relevant submissions, and an assessment of the preferred options against ComReg's statutory powers, functions, objectives and duties;
- **Annex 7:** sets out ComReg's proposals and consideration of relevant submissions on the alignment of the different expiry dates of existing licences in the 2.1 GHz Band in 2022;
- **Annex 8:** sets out an updated draft RIA, taking into account updated information and relevant submissions, informing ComReg's proposal to liberalise existing rights of use in the 2.1 GHz Band and to timing considerations around same;

- **Annex 9:** sets out an updated draft RIA, taking into account updated information and relevant submissions, informing ComReg's proposed coverage obligations for rights of use in the 700 MHz Duplex;
- **Annex 10:** details the description, including the names, locations and geographic boundaries, of the specific locations which would be included as part of ComReg's proposed coverage obligations for rights of use in the 700 MHz Duplex;
- **Annex 11:** sets out an updated draft RIA, taking into account updated information and relevant submissions, informing ComReg's proposed rollout obligations for rights of use in the 2.1 GHz, 2.3 GHz and 2.6 GHz Bands;
- **Annex 12:** sets out an updated draft RIA, taking into account updated information and relevant submissions, informing ComReg's proposed quality of service ("QoS") (including voice over LTE ("VoLTE")) and network availability obligations;
- **Annex 13:** sets out a draft RIA regarding indoor mobile voice and text coverage;
- **Annex 14:** sets out the technical licence conditions applicable to the Proposed Bands; and,
- **Annex 15:** sets out ComReg's consideration of other matters raised by respondents to Document 19/59R which are not already addressed in the main body of this document.

Chapter 2

2 Background Information

2.1 In this Chapter, ComReg sets out some background information relevant to the Proposed Award, including information on:

- the spectrum bands considered for award comprising:
 - the bands proposed for award;¹⁸ and
 - briefly the bands not proposed for award at this stage;¹⁹
- the connectivity studies published by ComReg in November 2018²⁰;
- spectrum management considerations in relation to Broadband Public Protection and Disaster Relief (BB-PPDR);
- the adoption of Directive (EU) 2018/172 establishing the European Electronic Communications Code (EECC) in December 2018;²¹
- cybersecurity of 5G networks; and
- Ireland's National Broadband Plan.

2.1 Spectrum band information

2.2 This section sets out summary information²² on the spectrum bands under consideration in this Proposed Award in the context of:

- the degree of harmonisation;
- equipment availability;
- the availability of spectrum; and
- awards in other Member States.

¹⁸ The 700 MHz Duplex, Paired 2.1 GHz, 2.3 GHz and 2.6 GHz Bands were proposed for award in Document 19/59R.

¹⁹ The 700 MHz Duplex Gap and Guard Bands, 1.4 GHz, Unpaired 2.1 GHz and 26 GHz Bands were not proposed for award at this time in Document 19/59R.

²⁰ ComReg Documents 18/103, 18/103a, 18/103b, 18/103c and 18/103d

²¹ [Directive \(EU\) 2018/1972](#) of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code.

²² Information on each of the spectrum bands is set out in tabular form in Annex 4 of this document.

2.1.1 Degree of harmonisation

Summary of Document 19/59R

2.3 In Annex 4 and Section 2.1 of Document 19/59R, ComReg set out information on the international harmonisation status of each of the spectrum bands under consideration. In summary, this indicated that all of these spectrum bands were harmonised via an ECC Decision and/or an EC Decision, with the exception of the Unpaired 2.1 GHz Band²³.

Updated information

2.4 Since Document 19/59R was published in June 2019, ComReg notes the following harmonisation updates:

- an updated ECC Decision (05)05 for the 2.6 GHz Band was adopted in July 2019;
- CEPT Report 72 was finalised and submitted to the EC for its consideration in the review and updating of the existing EC Decisions for the 2.1 GHz and 2.6 GHz bands; and
- two draft EC Decisions to update EC 2012/688 on the 2.1 GHz Band and EC 2008/477 on the 2.6 GHz Band have been discussed in the EC Radio Spectrum Committee (RSC) meeting of 11 December 2019.

2.5 Should EC Decisions be adopted for the 2.1 GHz and 2.6 GHz Bands, then ComReg observes that all of spectrum bands proposed for this award would be harmonised to enable the use of 5G.

2.1.2 Equipment availability

Summary of Document 19/59R

2.6 In Document 19/59R, ComReg noted that information from the Global mobile Suppliers Association (GSA)²⁴ indicated a high availability of LTE devices for the spectrum bands proposed for award, and that 5G devices were just becoming available for the 700 MHz Duplex and 2.6 GHz Band.

²³ Regarding harmonisation of the 2.1 GHz Unpaired Band, ECC Decision (06)01 facilitated the use of MFCN in the band, and this was later amended by ECC Decision (15)02, which then harmonised the Unpaired Band for Direct Air-to-Ground Communications. However, ECC Decision (15)02 was later withdrawn by ECC (18)01. <https://www.ecodocdb.dk/download/0bc97406-7dbd/ECCDec1801.pdf>.

²⁴ www.gsacom.com

2.7 For the spectrum bands not proposed for award, ComReg noted that there was no equipment available for the 700 MHz Duplex Gap and 700 MHz Guard Band or the 1.4 GHz Extension Bands, and that the availability of 5G devices for the 26 GHz Band was low at 5 devices.

Updated information

2.8 Annex 4 of this document sets out updated information on the LTE and 5G device availability for the spectrum bands under consideration.

2.9 Focusing on the bands proposed for award, ComReg observes that:

- there continues to be a high availability of 4G LTE devices in these bands which continues to increase; and
- 5G devices are now available in all the proposed bands, albeit few in number.

Table 1: 4G/LTE and 5G Device availability in the proposed bands

Band ²⁵	4G devices November 2019	5G devices November 2019
700 MHz Duplex (B28, FDD) (n28, FDD)	2,098	12
2.1 GHz (B1, FDD) (n1, FDD)	8,905	11
2.3 GHz (B40, TDD) (n40, TDD)	5,479	3
2.6 GHz (B7, FDD) (n7, FDD)	9,351	9
(B38, TDD) (n38, TDD)	4,156	4

2.1.3 Spectrum availability

Summary of Document 19/59R

2.10 In Document 19/59R, ComReg noted that that all of the spectrum bands proposed for award are available in Ireland, albeit that there were co-existence issues to address in relation in the 2.3 GHz and 2.6 GHz bands given Eir's RurTel network and aeronautical radar.

²⁵ All the bands presented in this table are identified as such by the 3GPP. Also, provided in parenthesis below is the 4G and 5G band number assigned by the 3GPP to each band.

Updated information

2.11 Since Document 19/59R was published, ComReg notes that:

- Eir has decommissioned the RurTel network in Kerry and the number of RurTel base stations has reduced in the Galway and Donegal networks. Plum has plotted revised composite interference contours, showing that the area where coordination is necessary is now reduced given the decommissioning of Kerry RurTel network (see Document 19/124c).
- Plum has updated its co-existence analysis for the 2.6 GHz Band to take account of the field measurements at the Shannon Air Traffic Control (ATC) radar and the new information from the Irish Aviation Authority (IAA) regarding the delayed decommissioning of Thales TA 10M TD radar. As noted in Plum's report (see Document 19/124d) the Thales TA 10M TD radar could significantly impact the deployment of WBB/MFCN in Dublin and the surrounding area.

2.1.4 Awards in other European countries

Summary of Document 19/59R

2.12 In Annex 4 of Document 19/59R, ComReg set out information on the status of spectrum awards in other European countries, while section 2.1.4 set out information on the recently completed spectrum awards in Europe.

Updated information

2.13 Annex 4 of this document sets out updated information on the status of spectrum awards in other European countries. Since Document 19/59R was published, no further spectrum awards have been completed in Europe.²⁶

2.2 Connectivity studies

Summary of Document 19/59R

2.14 In Section 2.2 of Document 19/59R, ComReg set out information on the

²⁶ All information in this section is sourced from Cullen International (www.cullen-international.com) (a pay subscription website) unless otherwise stated.

Connectivity Studies²⁷ published in November 2018. These studies provide advice on different aspects of providing connectivity in Ireland, including estimated costings to extend mobile coverage to a high level.

- 2.15 In addition, ComReg summarised the key messages and recommendations in these studies, as published in ComReg's Information Notice²⁸.
- 2.16 ComReg also noted that the Connectivity Studies assist it in the development of proposals for the Proposed Award, and in particular its consideration of appropriate coverage obligations. It encouraged interested parties to consider this information.

Summary of respondents' views

- 2.17 Two respondents (Mr. Young and Vodafone) submitted views on the Connectivity Studies. A summary of the respondents' views is available in Annex 3 of this document and the key points from these respondents are set out below.
- 2.18 In relation to the Oxera connectivity report (Document 18/103c) both Mr. Young and Vodafone consider that this provides comprehensive analysis in that it allows for a considered quantification of the additional investment needed to increase coverage to high levels. While Vodafone is of the view that Oxera may overstate the level of coverage that will be reached without intervention²⁹, Mr. Young on the other hand believes that Oxera may underestimate this³⁰.
- 2.19 In relation to the DotEcon connectivity study (Document 18/103d), Mr. Young submits that ComReg should adopt an interventionist approach to setting licence obligations to ensure minimum coverage and download speeds, rather than the precautionary approach favoured by ComReg in its consultation document. In outline, Mr Young submits that ComReg should:
- set much more challenging network coverage and minimum download speed conditions than those set out in the consultation document; and
 - not allow its approach to the spectrum award to be influenced by the National Broadband Plan (NBP).

²⁷ The Connectivity studies are:

- *"Meeting Consumers' Connectivity Needs"* – a report (Document [18/103b](#)) and accompanying infographic (Document [18/103a](#)) from Frontier Economics Ltd (Frontier)
- *"Future Mobile Connectivity in Ireland"* - a report (Document [18/103c](#)) from Oxera Consulting LLP (Oxera), with Real Wireless Ltd; and
- *Coverage obligations and spectrum awards* – a report (Document [18/103d](#)) from DotEcon

²⁸ Document [18/103](#) - *"Improving connectivity in Ireland – Challenges, solutions and actions."*

²⁹ See paragraph 15 of Vodafone's response to Document 19/59R.

³⁰ See paragraphs g-o of Mr. Young's response to Document 19/59R.

- 2.20 Mr Young expressed the view that “*ComReg’s statutory obligations regarding maximising the use of Ireland’s radio spectrum resources for Irish consumers is unqualified*” and, accordingly, ComReg should not be constrained by overlapping plans for fixed network solutions.

Summary of Oxera and DotEcon’s assessment of respondent’s views

- 2.21 Oxera and DotEcon have separately considered the respondents’ views in relation to their respective connectivity reports. These assessments are set out in Documents 19/124f and 19/124b respectively. In these documents, both DotEcon and Oxera outline in their view that following the assessment of the comments received, there is no need to modify or update their reports.
- 2.22 Oxera notes that “*Having considered the comments made by respondents in relation to the report (as described above), we are of the view that the modelling approach and inputs are robust and appropriate, and that the conclusions we draw remain reasonable and justified*”
- 2.23 DotEcon notes that “*Mr Young has not raised any points to cause us to amend or reconsider the conclusions of our original report.*”
- 2.24 In addition, and in relation to the procurement of interventionist coverage obligations, DotEcon adds that: “*Given the current high degree of uncertainty about how future 5G developments will affect incentives to compete on coverage, and given the potential for ComReg to intervene in a variety of different ways, we consider that there is significant merit in waiting and seeing what competition between operators might deliver after the MBSA2. In the event that reasons to intervene subsequently emerge, the State can then formulate specific targeting interventions which could be procured as a commitment from operators in a flexible manner, purchasing such commitments where the cost of doing so is justified given the benefits.*”

ComReg’s updated view

- 2.25 ComReg has carefully considered the respondents’ views and notes that these views have been properly considered by its expert advisors, Oxera and DotEcon, in relation to their respective connectivity reports.
- 2.26 Having carefully considered the views of Oxera and DotEcon, ComReg is of the view that no additional points have been raised that would require Oxera or DotEcon to amend or reconsider the conclusions of their connectivity reports, and ComReg is also of the view that the key messages and recommendations

of the Connectivity Studies³¹ remain valid.

- 2.27 The matters set out in this consultation document continue to be informed by the Connectivity Studies³² and the updated reports of Oxera (Document 19/124f) and DotEcon (Document 19/124b) considering the responses to Document 19/59R.

2.3 BB-PPDR spectrum management considerations

Summary of Document 19/59R

- 2.28 Section 2.3 of Document 19/59R set out information on the spectrum management considerations for BB-PPDR in Ireland. Among other things, this summarised

- the key findings of the LS telecom BB-PPDR report³³; and
- ComReg's draft spectrum management assessment³⁴ of the quantity of 700 MHz Duplex spectrum to include in the Proposed Award.

- 2.29 In this regard, ComReg stated that it was of the preliminary view that progressing the Proposed Award on the basis of including the full 2x30 MHz of the 700 MHz Duplex would be the most appropriate option in terms of ComReg's spectrum management function and objectives.

- 2.30 In respect of spectrum for BB-PPDR, ComReg noted that there are a range of technically-viable deployment and other spectrum options available, and it noted that:

- it has proposed to make available 2x3 MHz of spectrum in the 410 - 430 MHz band for BB-PPDR; and
- spectrum in the 700 MHz Duplex Gap and 700 MHz Guard Bands (i.e. Band 68 (2x5 MHz) and Band 28B (2x3 MHz)) could also be made available for BB-PPDR use if required, in line with the flexibility afforded the State in respect of same under the 700 MHz EC Decision.

- 2.31 ComReg also noted that its preliminary view is without prejudice to any future decisions which the State may take in relation to the use of the 700 MHz Band under the 700 MHz EC Decision.

³¹ As set out in paragraph 36 in Document [18/103](#) - "Improving connectivity in Ireland – Challenges, solutions and actions."

³² ComReg Documents 18/103, 18/103a, 18/103b, 18/103c and 18/103d.

³³ Document 19/59e, "Study on Terrestrial BB-PPDR Spectrum Options", June 2019

³⁴ ComReg's draft spectrum management assessment is set out in Annex 3 of Document 19/59R.

Summary of respondent's views

2.32 Four respondents (Eir, Motorola, Three and Vodafone) submitted views on the BB-PPDR spectrum management considerations. A summary of these is set out in Annex 5 of this document, where among other things, this notes that:

- all four respondents supported the inclusion of the full 2x30 MHz of the 700 MHz Duplex in the Proposed Award; and
- Motorola also suggested that it may be appropriate to consider imposing BB-PPDR licence conditions on 2x10 MHz of the 700 MHz Duplex should it be envisaged that this band would be used to deliver BB-PPDR services in the future.

Summary of LS telcom's view

2.33 LS Telcom considered these views in Document 19/124e. Overall LS Telcom is of the view that *“there is no materially new information that would necessitate changes to the findings of our report and no update of that report is therefore required”*.

2.34 LS Telcom also confirms that its conclusions regarding the BB-PPDR spectrum options remain as set out in section 5 ComReg Document 19/59e.

Summary of ComReg's assessment

2.35 ComReg's assessment of the respondents' views is set out in Annex 5 of this document.

2.36 Overall ComReg remains of the view that progressing the Proposed Award on the basis of including the full 2x30 MHz of the 700 MHz Duplex would be the most appropriate option in terms of ComReg's spectrum management functions, objectives and duties.

2.37 In relation to spectrum options for BB-PPDR, ComReg plans to provide further information in Spring 2020 with the publication of an Information Notice.³⁵

³⁵ See ComReg's annual action plan for the year to 30 June 2020 <https://www.comreg.ie/media/2019/07/Annual-Action-Plan-Ye-30-June-2020.pdf>

2.4 European Electronic Communications Code

Summary of Document 19/59R

- 2.38 In Section 2.4 of Document 19/59R ComReg noted that on 20 December 2018, Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (“EECC”) entered into force.
- 2.39 The EECC replaces the EU Common Regulatory Framework adopted in 2002 (and amended in 2009) under which ComReg has regulated electronic communications since 2003.
- 2.40 With some limited exceptions (see Article 124 of the EECC), Member States have until 21 December 2020 to transpose the EECC into national law.³⁶ Until then, the existing EU Common Regulatory Framework will continue to apply. However, in developing its proposals for the Proposed Award, ComReg is mindful of the EECC.
- 2.41 DCCA will be responsible for transposition of the EECC and ComReg will provide assistance where appropriate.

Summary of respondents’ views and ComReg’s assessment

- 2.42 Three respondents (Eir, Three and Vodafone) submitted views in relation to the EECC, in summary believing that ComReg’s licence duration proposal would “contradict”, “undermine”, “compromise” the purpose of the EECC.
- 2.43 These views and ComReg’s assessment of same are discussed and addressed in the licence duration section of this document (see section 5.3) where overall ComReg is of the view that it does not see particular merit in assertions that its proposals are not consistent with the EECC (including “undermining”, “compromising”, “contradicting” the EECC).

2.5 Cybersecurity of 5G Networks

Summary of Document 19/59R

- 2.44 Section 2.5 of Document 19/59R set out information on the cybersecurity of 5G networks.
- 2.45 Undertakings or spectrum rights of use holders are obliged under Regulation 23 of the Framework Regulations to take appropriate technical and organisational

³⁶ With the exception of Articles 53(2), (3) and (4), and Article 54 (see Article 124).

measures to manage risks posed to the security of their networks / services and to prevent and minimise the impact of security incidents on users and interconnected networks. Similar obligations are contained in the EECC.³⁷

2.46 These security obligations continue to apply to operators that win spectrum in the Proposed Award.

2.47 On 26 March 2019, the European Commission adopted Recommendation 2335 on Cybersecurity of 5G networks (Recommendation 2335)³⁸ which recommends a common EU approach to the security of 5G networks.

2.48 Recommendation 2335 sets out a number of recommendations for EU Member States including three specific actions plus deadlines for their completion:

- Action 1: Member States, by 30 June 2019, are to assess the cybersecurity risks affecting 5G networks at national level and take necessary security measures.
- Action 2: Member States and relevant Union bodies, by 1 October 2019, are to develop a coordinated Union risk assessment that builds on the national risk assessments.
- Action 3: The “Cooperation Group”³⁹, by 31 December 2019, is to identify a possible common “Union toolbox”, or set of measures to mitigate cybersecurity risks, in particular for 5G networks.

2.49 ComReg is working with and assisting the National Cyber Security Centre (NCSC)⁴⁰ which is progressing the matters on Ireland’s behalf.

2.50 In addition, point 4(c) of Recommendation 2335 also provides that:

“On the basis of the national risk assessment and review and taking into account ongoing coordinated action at Union level, Member States should:

(c) attach conditions to the general authorisation concerning the security of public networks against unauthorised access and ask for commitments from the undertakings participating in any upcoming

³⁷ See Article 40 – Security of networks and services, of the EECC.

³⁸ [Recommendation C\(2019\) 2335 - Cybersecurity of 5G networks](#) (Rec. 2335)

³⁹ The Cooperation Group was established under Directive (EU) 2016/1148 (the Network and Information Systems Directive) to ensure strategic cooperation and the exchange of information among Member States in cybersecurity. It is composed of representative of Member States, the European Commission and the EU Agency for Network and Information Security.

⁴⁰ The NCSC is the government computer security organisation in Ireland, an operational arm of the Department of Communications, Climate Action and the Environment.

procedures for granting rights of use for radio frequencies in 5G bands as regards compliance with security requirements for networks pursuant to Directive 2002/20/EC;

- 2.51 Condition 19 of the General Authorisation (03/81R6⁴¹) and S.I. No. 336/2011⁴² already include measures, in respect of ensuring the security of public electronic communications networks against unauthorised access.
- 2.52 Regarding the common set of measures to mitigate against cybersecurity risks, or the “Union toolbox”, this is expected to be published by 31 December 2019. ComReg will consider the output of the Cooperation Group when it is known and any implications that might arise in respect of this award process.

Updated information

- 2.53 Action 1 and Action 2 of Recommendation 2335 have now been completed.
- 2.54 On 9 October Member States, with the support of the European Commission and the European Agency for Cybersecurity, published a high-level report on the coordinated risk assessment of 5G networks.⁴³

Summary of respondents’ views and ComReg’s assessment

- 2.55 One respondent (Eir) to Document 19/59R noted the references to the ‘Union toolbox’ for cybersecurity in Document 19/59R and expected that there would be due consultation at the appropriate time should ComReg feel it necessary to include any related measures in the Proposed Award process, for example in the terms of the rights of use.
- 2.56 ComReg notes this view and will consider carefully whether it is appropriate to consult on this issue in due course.

2.6 Ireland’s National Broadband Plan (NBP)

Summary of Document 19/59R

- 2.57 Section 2.6 of Document 19/59R set out information on Ireland’s National Broadband Plan, which is the Government’s plan to ensure that all premises in Ireland have access to high speed broadband services.

⁴¹ <https://www.comreg.ie/publication/general-authorisation-for-the-provision-of-electronic-communications-networks-and-services/>

⁴² S.I. No. 336/2011 - European Communities (Electronic Communications Networks and Services) (Privacy and Electronic Communications) Regulations 2011
<http://www.irishstatutebook.ie/eli/2011/si/336/#>

⁴³ EU coordinated risk assessment of the cybersecurity of 5G networks, 9 October 2019, <https://ec.europa.eu/digital-single-market/en/news/eu-wide-coordinated-risk-assessment-5g-networks-security>

2.58 ComReg noted that the NBP is an important project in the overall solution for connectivity in Ireland, and that in May 2019, the Irish Government approved the appointment of a "Preferred Bidder". Further ComReg noted its projected timelines which envisaged that the NBP rollout would commence in Q4 2019 with the majority of premises being passed in the initial 5 years, and the overall rollout being concluded within 7 years.

Updated information

2.59 In November 2019, and following a further consultation on the conclusion of the NBP mapping exercise⁴⁴ and EU state aid approval⁴⁵, the Government signed the NBP contract.⁴⁶

2.60 In relation to the rollout, the DCCAIE indicates that:

- *Approximately 300 community centres, schools, library hubs and local GAA halls in every county in Ireland that will be connected to high speed broadband during 2020, to enable communities to quickly get free public access to high speed broadband.*
- *National Broadband Ireland will pass approximately 10,000 premises by the end of 2020. By the end of 2021, National Broadband Ireland plans to pass approximately 115,000 premises. Approximately 70,000-100,000 premises will be passed each year thereafter with the final premises to be completed in 2026. (emphasis added)*

⁴⁴ <https://www.dccae.gov.ie/en-ie/communications/consultations/Pages/Conclusion-of-NBP-Mapping-Exercise.aspx>

⁴⁵ https://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=3_SA_54472

⁴⁶ DCCAIE press release "[Government sign the National Broadband Plan Contract](#)", published 22 November 2019.

Chapter 3

3 The Proposed Bands and Preferred assignment process

3.1 Summary of ComReg's view in Document 19/59R

3.1 In Chapter 3 of Document 19/59R, ComReg set out its consideration of the submissions to Document 18/60 and its preliminary view that:

- the 700 MHz Duplex, the 1.4 GHz Centre Band, the 2.1 GHz Band, the 2.3 GHz Band and the 2.6 GHz Band were to be considered further in the draft Spectrum for Award RIA; and,
- the 700 MHz Duplex Gap and 700 MHz Guard Bands, the 1.4 GHz Extension Bands, the Unpaired 2.1 GHz Band and the 26 GHz Band should not be included in the Proposed Award.

3.2 In Chapter 4 of Document 19/59R, ComReg set out its:

- draft Spectrum for Award RIA and its preferred option;
- draft Assignment Process RIA and its preferred option; and,
- consideration of ComReg's overall preferred option against ComReg's relevant statutory functions, objectives and duties other than those analysed in the draft RIAs.

Draft Spectrum for Award RIA

3.3 The draft Spectrum for Award RIA considered four options from the perspective of stakeholders as well as its impact on competition and consumers.

3.4 The four regulatory options considered were:

- **Option 1** - Assign rights of use for the 700 MHz Duplex and 2.6 GHz Band only.
- **Option 2** - Include the 2.3 GHz Band in any award process assigning rights of use in the 700 MHz Duplex and 2.6 GHz Band.
- **Option 3** - Include the 2.1 GHz Band in any award process assigning rights of use in the 700 MHz Duplex and 2.6 GHz Bands.

- **Option 4** - Include the 1.4 GHz Centre Band in any award process assigning rights of use in the 700 MHz Duplex and 2.6 GHz Bands.

3.5 For the reasons set out in the draft Spectrum for Award RIA, ComReg's preliminary view was that its preferred option is to include the 700 MHz Duplex, 2.6 GHz Band, 2.3 GHz Band and 2.1 GHz Band in the Proposed Award (i.e. Options 2 and 3 together) ("Award Bands").

Draft Assignment Process RIA

3.6 The draft Assignment Process RIA considered three options from the perspective of stakeholders as well as its impact on competition and consumers.

3.7 The three regulatory options considered were:

- **Assignment Option 1:** Assignment of all available spectrum using a competitive, open, transparent auction format; or
- **Assignment Option 2:** Assignment of some or all available spectrum band by administrative assignment. In particular:
 - **Assignment Option 2A:** Assignment of 2x10 MHz of 700 MHz Duplex rights of use to each MNO by administrative assignment in return for interventionist coverage obligations.⁴⁷
 - **Assignment Option 2B:** Assignment of 2x20 MHz of 2.1 GHz rights of use to each MNO by administrative assignment in return for fees that reflect the market value.⁴⁸

3.8 Each option is not mutually exclusive and the preferred option could involve one or more of the above options.

3.9 For the reasons set out in the draft Assignment Process RIA, ComReg's preliminary view was that its preferred option is to make available all relevant spectrum rights using an open appropriate auction format (i.e. Assignment Option 1).

⁴⁷ As set out in paragraphs 4.144 to 4.147 of Document 19/59R, Assignment Option 2A was based on an assignment suggestion from Eir in its response to Document 18/60.

⁴⁸ As set out in paragraph 4.143 of Document 19/59R, Assignment Option 2B was based on an assignment suggestion contain in the Nera Report (commissioned by Three), a submission to Document 18/60.

Assessment against ComReg's other relevant functions, objectives and duties

- 3.10 ComReg's overall preferred option⁴⁹ was then considered against ComReg's other relevant functions, objectives and duties. This is set out in Section 4.5 of Document 19/59R.⁵⁰

3.2 The proposed spectrum bands

- 3.11 This section considers the views of respondents on the proposed spectrum bands, including any views on the draft Spectrum for Award RIA.

3.2.1 Views of respondents

- 3.12 Six respondents (Dense Air, Eir, Ericsson, Mr. Liam Young, Three and Vodafone) provided views on the spectrum bands proposed for award.

The 700 MHz Duplex, 2.3 GHz and 2.6 GHz bands

- 3.13 In relation to the 700 MHz Duplex, 2.3 GHz and 2.6 GHz bands, all six respondents agreed with ComReg's proposals to include these bands in the award. Supporting views included that:
- the proposed Multi Band Award will help realise the full potential of 5G network deployments and meet the growing demands on network performance enabling 5G use cases that will bring social and economic benefits to Ireland. (Ericsson);
 - spectrum in the 700 MHz band is important. It tends to be better for providing rural coverage and building penetration. The 700 MHz band has also been identified as a 5G "pioneer band" for Europe so it can be expected that there will be a good supply of network and terminal equipment. (Three);
 - TDD spectrum in 2.3 GHz and 2.6 GHz bands will promote the rapid deployment of pervasive 4G LTE and support mass deployment of both Standalone and Non-Standalone 5G networks. (Dense Air);
 - 2.3 GHz is currently one of the most deployed mid-band spectrum bands for 4G services, with massive deployment across the globe including Europe and Asia, with a wide and extensive eco-system that

⁴⁹ Its preferred option from its draft Spectrum for Award RIA and its draft Assignment Process RIA.

⁵⁰ In this document, Annex 6.7 sets out ComReg's assessment of its overall preferred option against its other relevant functions, objectives and duties.

enables low cost services in both Mobile and Fixed Wireless solutions. (Dense Air);

- 2.6 GHz (Band 38) deployments are also happening at scale in other countries, especially in Japan and North America. Over 250,000 indoor small cells have been deployed in the USA and over 20,000 outdoor small cells, on poles and/or cable strands. (Dense Air);
- the 2.6 GHz band has been standardised within Europe for several years, and is in common use. (Three); and
- the proposed spectrum auction provides the opportunity for operators to increase their spectrum assignments to match those in other countries and so allow Irish consumers and business to gain access to high quality services, full use of available handsets and the advantage of pan-European services. (Vodafone)

The 2.1 GHz Band

3.14 In relation to the 2.1 GHz Band:

- four respondents (Dense Air, Ericsson, Mr. Liam Young, and Vodafone) broadly agreed with the proposed inclusion of this band;
- one respondent (Three) saw difficulties around ComReg's proposed inclusion of the 2.1 GHz Band, as this band is already in use to provide 3G services; and
- one respondent (Eir) did not agree with the proposed inclusion of the 2.1 GHz Band as it believes that the circumstances surrounding this band are materially different to the other bands.

3.15 In support of its view, Eir submitted that:

- i. spectrum in the 2.1 GHz Band is in use and is integral to the operation of the mobile networks in Ireland as operators have acquired sites in locations to optimise network performance at 2.1 GHz spectrum. In this regard, Eir believes that if an existing operator fails to acquire 2.1 GHz spectrum in the Proposed Award and is forced to migrate to the 2.6 GHz Band, this would result in a need for alternative and / or additional base station sites to provide an equivalent level of geographic coverage. Eir contends that this would not be an efficient outcome;
- ii. the proposed inclusion of the 2.1 GHz Band is unfair, as in Eir's view it is at a different point in the investment cycle of its current 3G

licence relative to Three and Vodafone who have fully paid off their spectrum access fees and are able to maximise their return on investment on the 3G licences. Eir believes that its previously submitted concerns regarding fairness were not adequately addressed, and it believes that ComReg (referring to paragraph 3.91 of Document 19/59R) has erred by being overly reliant on DotEcon's assessment that all bidders are equal in what Eir believes is essentially a "2.1 GHz licence renewal auction"; and

- iii. the proposed inclusion of the 2.1 GHz Band introduces unnecessary complication into the award process due to the need for time-slicing.

Bands not proposed – the 700 MHz Duplex gap, the 1.4 GHz Band and the 26 GHz Band

3.16 In relation to the bands not proposed for this award process, two respondents (Three and Vodafone) agreed with ComReg's proposal. Views submitted include that:

- the ecosystem to support this use of the 700 MHz Duplex Gap is not well developed yet. (Three);
- the ecosystem for the 1.4 GHz Band is not yet developed, and operators would benefit from greater certainty regarding the business case for deployment of supplemental downlink using these frequencies. (Three);
- the characteristics of the 26 GHz Band are significantly different to those of the [other bands]⁵¹ in the Proposed Award, and the network and device ecosystem is less advanced. (Three);
- there are several issues to be considered in order to optimise the 26 GHz Band before an award, and reconfiguration might be necessary. Three is of the view that a separate consultation is required to resolve these matters. Accordingly, it agrees that this band should be awarded in a separate process, so as not to delay the award of the lower frequency spectrum. (Three);
- It is necessary that, in parallel with the Proposed Award, ComReg issues a clear plan for a future auction of the other bands discussed in Document 18/60, namely additional 700 MHz spectrum, the complete 1.4 GHz Band and spectrum in the 26 GHz Band. (Vodafone)

⁵¹ The original sentence is slightly unclear – the added words clarify ComReg's understanding of the meaning of the sentence.

3.2.2 Updated Information

- 3.17 Updated information (equipment availability, award status in Europe, harmonisation and spectrum availability) on the spectrum bands under consideration for this proposed award is set out in Annex 4 to this document.
- 3.18 For the spectrum bands proposed for award (i.e. the 700 MHz Duplex, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands), this information shows that these bands are all available for award and that all of the bands are harmonised with an EC Decision or ECC Decision. It also shows that all of these bands have a well-developed LTE device ecosystem of 2000 or more devices.
- 3.19 For the spectrum bands not proposed for award (i.e. the 700 MHz Duplex Gap and Guard Bands, 1.4 GHz Band and 26 GHz Band) this information shows that these bands are still developing. Further ComReg notes that:
- while these bands are all harmonised bands with an EC Decision or ECC Decision, the device ecosystem for these bands is non-existent to low; and
 - each of these bands have availability of spectrum considerations that will require further time to address. Specifically:
 - in the 700 MHz Duplex Gap & Guard Bands some spectrum may be required for BB-PPDR;
 - in the 1.4 GHz Band there are existing fixed links that would need to be migrated; and,
 - in the 26 GHz Band, while there currently is greater than 1.4 GHz of unused spectrum in this bands. Other parts of this band are licensed to other users.

3.2.3 ComReg's assessment of respondents views

The 700 MHz Duplex, the 2.3 GHz Band and the 2.6 GHz Band

- 3.20 In relation to the 700 MHz Duplex, 2.3 GHz Band and 2.6 GHz Band, ComReg notes that six respondents (Dense Air, Eir, Ericsson, Mr. Liam Young, Three and Vodafone) agreed with ComReg's proposals to include these bands in the Proposed Award.
- 3.21 ComReg also notes that the supporting views provided by these respondents align with ComReg's analysis set out in previous consultations (Documents 18/60 and 19/59R). Among other things, these supporting views include that:

- these bands are all harmonised for WBB and have well developed device ecosystems;
- the 700 MHz Duplex is an important band for the provision of 5G services and WBB coverage in rural areas; and,
- the 2.3 GHz and 2.6 GHz are suitable for mobile and fixed wireless broadband solutions and there are already substantial deployments in these bands.

3.22 Noting the updated views of respondents for these bands and the updated information on these spectrum bands, ComReg has updated its draft Spectrum for Award RIA (see Annex 6 of this Document).

3.23 Given the above, ComReg remains of the view that it is appropriate to include the 700 MHz Duplex, 2.3 GHz Band and 2.6 GHz Band in the proposed award.

The 2.1 GHz Band

3.24 In relation to the 2.1 GHz Band, ComReg firstly notes that five respondents (Dense Air, Ericsson, Mr. Liam Young, Three and Vodafone) broadly agreed with the inclusion of the 2.1 GHz Band in the Proposed Award, while one respondent (Eir) did not as summarised in paragraph 3.15 above.

3.25 In relation to bullet point (i) of paragraph 3.15, while accepting that MNOs have deployed a significant amount of equipment using the 2.1 GHz Band, ComReg would not characterise the use of this band as being integral to the operation of mobile networks in Ireland or be of the view that the use of an alternative frequency band (e.g. 2.6 GHz) would not be an efficient outcome as:

- Mobile networks operators now use many spectrum bands and many different technologies to provide mobile services⁵², and MNOs no longer has a reliance solely on any one particular band or technology. This is particularly the case where a MNO has sufficient time to prepare for a transition from one band to another, which would be the case with Eir given the 2027 expiry date of its 3G licence. Further with the release of additional spectrum bands and the greater use of multiple technologies in networks and devices, any reliance on specific spectrum bands is likely to reduce further.
- While currently there may some substitutability issues between the 2.1 GHz Band and other above-1 GHz bands (e.g. 2.6 GHz Band), these

⁵² MNOs in Ireland have spectrum assignments in the 800 MHz, 900 MHz, 1800 MHz and 2.1 GHz bands, and these bands are used to provide voice and data services over 2G (voice and basic data), 3G (voice and data) and 4G (4G data and voice with VoLTE) networks.

are of a short-term nature. In the medium to long-term the 2.1 GHz Band and the 2.6 GHz can be considered substitutes given that these bands will likely be used for the same purposes (e.g. deploy 4G or 5G services)⁵³ particularly in areas where capacity is required.

- Assigning rights of use to the bidder who values them most should deliver an efficient outcome.
- If there were potential migration costs in migrating to another band, Eir would be expected to reflect the avoidance of these costs in its valuation of the spectrum. Eir would only fail to acquire spectrum if other bidders could extract a value from it that exceeds the value to Eir of avoiding such migration costs. This would be an efficient outcome in the circumstances of an auction, as spectrum rights would be assigned to the bidder who values them most.

3.26 In relation to bullet point (ii) of paragraph 3.15, ComReg observes that this view has already been considered by ComReg in Document 19/59R and DotEcon in Document 19/59a, where ComReg noted and agreed with DotEcon's advice that:

- If Eir *“were to win 2.1 GHz spectrum in time slice 2, it would not be paying for a licence renewal, but for a new licence (albeit potentially for the same frequencies)”*;
- *“there is no reason that payments in regard to new time slice 2 assignments should be treated in different ways for different winners according to what other spectrum licences they currently hold, as in time slice 2 all bidders are in similar positions with all of the available 2.1 GHz spectrum available for award”*; and
- *“In addition, the payment terms faced by [Eir] Meteor in this situation would be similar to any other operator that was to win 2.1 GHz spectrum in both time slices (whether awarded as two separate licences or one continuous licence); those bidders would also be required to pay in advance for access to the spectrum over the period of time slice 2 and at the same time as paying for access over the first time slice”*.; and
- *“We [DotEcon] therefore do not agree that [Eir] Meteor would be at any significant disadvantage relative to other operators in this regard, and if we were to defer payments for time slice 2 spectrum rights then this would have to be for all bidders and not just Meteor.”*

3.27 In addition, ComReg notes that should it not propose to include the 2.1 GHz

⁵³ For example, [“Vodafone UK eyeing 3G switch-off in ‘two to three years’](#)”, June 11 2019.

Band in the Proposed Award, then:

- other licensees, Three and Vodafone could be at a disadvantage relevant to Eir as their licences would expire shortly after the Proposed Award creating uncertainty for them as to the potential for obtaining new rights in the 2.1 GHz Band; and
- this would not be an efficient award, as in the medium to long run, the 2.1 GHz band will provide capacity for 4G/5G networks alongside other high-frequency bands proposed for this award. These bands are therefore medium to long-run substitutes and, given the expiry dates of the existing licences in the band, it is appropriate to include the 2.1 GHz band in the Proposed Award, as discussed in ComReg's draft "spectrum band" RIA in Annex 6.

3.28 In relation to bullet point (iii) of paragraph 3.15, ComReg observes that the complexity of the award process is considered and addressed by both DotEcon and ComReg in the specific award proposal sections (i.e. time slices, auction format, competition caps) later in this document. As noted in section 4.4 when discussing time slices, ComReg agrees with DotEcon's view that any additional complexity created as a result of times slices is minor relative to the benefit of including time slices and in any case, the additional complexity primarily resides with the auctioneer rather than the bidders.

3.29 Noting the latest views of respondents for this band and the updated information, ComReg has updated its draft Spectrum for Award RIA (see Annex 6 of this Document),

3.30 Given the above, ComReg remains of the view it is appropriate to include the 2.1 GHz Band in the proposed award.

The 700 MHz Duplex Gap, 1.4 GHz Band and the 26 GHz Band

3.31 In relation to the bands not proposed for this award process, ComReg observes that two respondents (Three and Vodafone) agreed with ComReg's proposal to exclude the 700 MHz Duplex Gap, 1.4 GHz Band and the 26 GHz Band from the proposed award, while no respondent disagreed.

3.32 In relation to the rationale provided by Three, ComReg agrees that:

- the ecosystem for the 700 MHz Duplex gap and the wider 1.4 GHz Band is not well developed yet and greater certainty regarding the business case for deployment of supplemental downlink would be beneficial;
- the characteristics of the 26 GHz Band are significantly different to those in the proposed award, and a separate consultation would be

necessary to optimise an award process for the 26 GHz Band. Further, ComReg notes that the device ecosystem for this band is low at just 6 devices currently.

- 3.33 In relation to Vodafone's request for ComReg to issue a clear plan for a future award of the 700 MHz Duplex Gap, 1.4 GHz Band and 26 GHz Band, ComReg observes that information on ComReg's award plans will become clearer over time and particularly as it develops its spectrum management strategy..
- 3.34 ComReg also refers interested parties to its current spectrum management strategy⁵⁴. In this strategy ComReg's sets out its envisaged spectrum actions for a 2-3 year period. The current strategy is for the period 2019-2021 and in this time period ComReg envisages that it would
- *Engage with the relevant stakeholders with a view to obtaining greater clarity on national policy on the use of the different portions of the 700 MHz Band in Ireland and, in particular, for PPDR;*
 - *Monitor developments in the 1.4 GHz [B]and for MFCN and consider the current and future use of the band in Ireland;*
 - *Monitor the progress of the developments in respect of 5G with a view to making a portion of the 26 GHz band available, if and when it is required.*
- 3.35 ComReg also refers interested parties to its public action plan⁵⁵ which set out ComReg's envisaged actions for its working year of July to June. In this working year, ComReg's action plan includes an action to issue an Information Notice and Consultant's report on the appropriate licensing framework or frameworks for assigning spectrum in the 26 GHz band for 5G.
- 3.36 Noting the updated views of respondents and updated information on these bands, ComReg has updated its draft Spectrum for Award RIA (see Annex 6 of this Document).
- 3.37 Given the above, ComReg remains of the view that it is not appropriate to include the 700 MHz Duplex Gap, 1.4 GHz Band and the 26 GHz Band in the proposed award.

⁵⁴ Document [18/118](#), "Radio Spectrum Management Strategy Statement 2019 to 2021", published 20 December 2018

⁵⁵ See ComReg's annual action plan for the year to 30 June 2020 <https://www.comreg.ie/media/2019/07/Annual-Action-Plan-Ye-30-June-2020.pdf>

3.2.4 ComReg's updated position

3.38 Having considered the above, and ComReg's updated draft Spectrum for Award RIA in Annex 6 of this Document and its assessment against its other relevant statutory functions, objectives and duties in Annex 6.7 of this Document, ComReg proposes to include the 700 MHz Duplex, the 2.1 GHz Band, the 2.3 GHz Band and the 2.6 GHz Band in the Proposed Award (the "Proposed Bands").

3.3 Preferred Assignment Process

3.3.1 Views of respondents to Document 19/59R

3.39 Four respondents (Eir, Imagine, Three and Vodafone) provided views on the preferred assignment process.

3.40 Imagine agreed with ComReg's preferred assignment process stating that *"FWA operators would elect for Assignment Option 1 (Auction) in preference to the other assignment options listed"*. In addition, Imagine submitted that should ComReg be minded to proceed with any other assignment option with an 'administrative' component, then this would only be acceptable if ComReg was to ensure that FWA Operators in addition to MNOs would be considered as relevant parties for receipt of any assigned 700 MHz spectrum.

3.41 Vodafone, in relation to the 2.1 GHz Band, stated that it agrees that an auction is the best way to award spectrum in that band at this time. It also believed that an administrative assignment could be considered in future processes, where there is a mature market with active spectrum leasing.

3.42 Three agreed with many aspects of ComReg's award proposals, but believed that ComReg's proposals "falls short" in a few areas. Three's submission on specific award proposals are discussed throughout this document in relevant sections.

3.43 Eir submitted an alternative assignment proposal for the 2.1 GHz Band, which it believed to be more proportionate. Specifically Eir proposed that:

- 2x15 MHz of spectrum in the 2.1 GHz Band be directly assigned to each of the three MNOs (Eir, Three and Vodafone) (i.e. 2x45 MHz in total) for the period covered by the proposed award;
- the remaining 2x15 MHz (3 lots), available on expiry of Three's A or B licence, be included in the proposed award without the need for time-slicing; and

- the outcome of the award in respect of remaining 2x15 MHz would provide a reference point for the fees to be applied to the directly assigned spectrum.

3.44 Eir expressed the view that its alternative proposal:

- has not previously been considered by ComReg, and
- addresses concerns raised in ComReg's draft Assignment Process RIA as the 3 lots included in the proposed award could also be of interest to new entrants (see paragraph 4.171 of Document 19/59R) and provide a reference for pricing of the assigned rights (see paragraphs 4.172-4.176 of Document 19/59R).

3.45 Eir also commented on paragraph 4.106 of Document 19/59R, where it stated that ComReg's view (that all of the 2.1 GHz Band must be included in the proposed award because there is insufficient time to do something different) is not an acceptable justification.

3.3.2 ComReg's assessment of respondents views

3.46 In relation to Eir's comment regarding the legitimacy of ComReg considering timing matters in relation to the award process of the 2.1 GHz Band (paragraph 4.106 of Document 19/59R), ComReg remains of the view that this is a relevant consideration, as practical matters such as the time required to carry out a proper consultation is an appropriate consideration to take into account.

3.47 In relation to Eir's alternative assignment proposal, ComReg notes that such an Option was already considered in the draft RIA through the assessment of Option 2A and 2B, noting that ComReg considered that each option was not mutually exclusive and that the overall preferred option could involve one or more of the above options.

3.48 However, to ensure that it has fairly considered all of the issues, in the revised draft Assignment Process RIA, set out in Annex 6, ComReg has included a new assignment option ("Assignment Option 2C") to assess Eir's alternative assignment proposal for the 2.1 GHz Band. ComReg is of the view that this facilitates a clear understanding of the relative merits of this assignment option in the context of its potential impact upon industry stakeholders, competition and consumers.

- *Assignment Option 2C: Directly assign 2x15 MHz to each of Eir, Three and Vodafone with the remainder to be included in the proposed award.*

3.49 In relation to the remaining views of respondents on the preferred assignment process, ComReg has modified its draft Assignment Process RIA (see Annex

6) as follows:

3.50 Assignment Option 1 has been modified to note:

- Imagine's submission that "*FWA operators would elect for Assignment Option 1 (Auction) in preference to the other assignment options listed*";
- Vodafone's submission that an auction is the best way to award spectrum in the 2.1 GHz Band at this time; and,
- Three's submission in that it agrees with many aspects of ComReg's award proposals.

3.51 Assignment Option 2A has been modified to make it clear that the possibility of an administrative assignment is to any operator, as requested by Imagine.

3.52 ComReg's updated draft Assignment Process RIA is set out in Annex 6.

3.3.3 ComReg's updated position

3.53 In light of ComReg's updated draft Assignment Process RIA in Annex 6 and its assessment against its other relevant statutory functions, objectives and duties in Annex Section 6.7 of this Document, ComReg's preferred option is to make available all relevant spectrum rights in the Proposed Bands using an open appropriate auction format (i.e. Assignment Option 1)

Chapter 4

4 Issues concerning the proposal to include the 2.1 GHz Band

4.1 This chapter is structured as follows:

- First, a summary is provided of ComReg's consideration of these issues in Document 19/59R.
- Second, a summary is provided of submissions received on these issues in response to Document 19/59R.
- Third, a summary is provided of DotEcon's consideration of those submissions.
- Finally, ComReg sets out its assessment of those submissions (with the exception of licence period alignment, which is set out separately in Annex 7).

4.2 In Chapter 5 of Document 19/59R, ComReg set out, under the following headings, its consideration of the issues arising from the potential inclusion of the 2.1 GHz Band in the Proposed Award and how it proposed to address each issue:

- Licence period alignment;
- 2.1 GHz Liberalisation;
- Time Slices in 2.1 GHz Band; and
- Time slices in other bands.

4.3 These headings are retained throughout this chapter.

4.1 Summary of ComReg's view in Document 19/59R

4.1.1 Licence period alignment

4.4 Three, Vodafone and Eir are currently assigned spectrum rights of use in the 2.1 GHz Band. Three and Vodafone's licences expire on different dates in 2022 while Eir's licence expires in 2027 (See Table 2 below).

Table 2: Details of current licences in the 2.1 GHz Band

Licence Holder	MHz	Expiry
Meteor Mobile Communications Ltd	2x15 MHz	11 March 2027
Three Ireland Hutchison Limited	<u>A Licence</u> 2x15 MHz	<u>A Licence</u> 24 July 2022
	<u>B Licence</u> 2x15 MHz	<u>B Licence</u> 1 October 2022
Vodafone Ireland Limited	2x15 MHz	15 October 2022

- 4.5 ComReg observed that a key issue to be addressed is the alignment of the varied expiry dates of existing 3G licences and the corresponding commencement of new 2.1 GHz rights of use.
- 4.6 ComReg proposed that Three should be provided with the option of applying for interim rights of use that would expire on the same date as Vodafone's licence (15 October 2022) (the detailed proposals for which were set out in Annex 5). This would allow for a common commencement date for new rights of use following the expiry of Vodafone and Three's licences.

4.1.2 2.1 GHz Liberalisation

- 4.7 In Chapter 5 of Document 19/59R, ComReg considered whether existing 2.1 GHz rights of use should be liberalised and, if so, what the timing of such liberalisation should be.
- 4.8 Based on its draft RIA (Annex 6 of Document 19/59R), ComReg came to the preliminary view that Option 2A (providing all existing licensees with the option to liberalise some or all existing 2.1 GHz rights of use from the time of the substantive decisions concerning the present Proposed Award) would be the more appropriate option in the context of its statutory obligations.
- 4.9 ComReg did not propose to apply any additional fees for liberalisation of existing 2.1 GHz licences for the period up until 15 October 2022, its newly proposed common expiry date for the current Vodafone and Three licences.
- 4.10 For the remainder of Eir's existing licence (from 15 October 2022 to 11 March 2027), ComReg considered that should the market price for 2.1 GHz rights of use exceed the price paid by Eir for its current licence, then it would be appropriate to apply additional fees to reflect that market price. The proposed methodology is discussed in paragraph 5.58 of Document 19/59R.

4.1.3 Time Slices in 2.1 GHz Band

4.11 A common start date for new rights of use of 16 October 2022 would reduce the number of time slices required in the 2.1 GHz Band to just two and see rights of use for the band awarded across two time periods. In that regard, ComReg proposed:

- to make available new 2.1 GHz rights of use in respect of spectrum for which existing rights of use are due to expire in October 2022 (i.e. 2x45 MHz) for the period 16 October 2022 to 11 March 2027 (to coincide with Eir's current licence expiry) ('**Time Slice 1**'); and
- to make available new 2.1 GHz rights of use for the full 2x60 MHz available in the 2.1 GHz Band, for the period 12 March 2027 until a common expiry date ('**Time Slice 2**').

4.1.4 Time Slices in other bands

4.12 In light of the above proposed approach for the 2.1 GHz Band, ComReg was of the view that the same time slices should be applied to the 2.3 GHz and 2.6 GHz bands on account of the likely substitutability between the three bands.

4.2 Views of respondents to Document 19/59R

4.13 ComReg received four submissions relating to matters discussed in Chapter 5 of Document 19/59R, namely from Eir, Imagine, Three and Vodafone. The views of the respondents are detailed below.

4.2.1 Licence period alignment

4.14 Eir supports the proposal to provide Three with the option to acquire interim rights of use to align its licence expiry date with the slightly later expiry date of Vodafone's 2.1 GHz Licence.

4.15 Vodafone proposes a single start date for all supra 1 GHz bands (e.g. June 2021) by allowing all current 3G Licence holders to surrender their 3G licences. Further, Vodafone notes that if its proposal is not adopted, then the start dates for new rights currently licensed to Three and Vodafone should be aligned.

4.16 Three recognises that having multiple different expiry dates is not desirable but considers the proposed licence fees for the interim licences to be inappropriate for a number of reasons. Three's more detailed views in relation to interim licence fees and ComReg's assessment of same are set out in Annex 7.

4.2.2 2.1 GHz liberalisation

4.17 Eir agrees that there should be an early liberalisation option but disagrees with ComReg's preferred option. Eir suggests that licensees should have the option to choose when to liberalise and that Option 2A would create too much uncertainty as the licensee would not be cognisant of all the relevant terms and conditions when making a decision whether or not to liberalise. Eir requests ComReg to confirm that the liberalisation option may be exercised at the licensee's discretion at any point in the period before a current licence expires.

4.18 Eir does not agree with the proposal to levy an additional fee for the liberalisation of its existing 2.1 GHz Licence and disagrees with the approach to calculating such fees. Eir submits that:

- it would be inappropriate to levy a fee that did not relate solely to liberalisation. In that regard, it notes that:
 - any difference will reflect not only the value of liberalisation but also any change in the value of 2.1 GHz rights of use between when Eir acquired its license and the date of the auction.
 - the prices paid by Three and Vodafone for 2.1 GHz rights of use will also reflect any value to Three and Vodafone of continuity of service mitigating the cost of being forced to a higher frequency band.
- ComReg should explain why the methodology to calculate the price of a 2.1 GHz lot includes Time Slice 2 rather than Time Slice 1 only.
- the methodology used by ComReg to calculate refunds for the 3.6 GHz Award is unrelated to liberalisation of existing licences.
- if ComReg intends to charge an additional fee if prices rise above the level of current licences, then ComReg should also give Eir a commensurate rebate in the event prices are lower than current licences.

4.19 Eir also requests clarification on how Eir's current price of €0.559 €/MHz/pop for its 2.1 GHz Licence has been calculated and why this is different for the other operators' licences.

4.20 Three suggests that if Eir takes up the option to liberalise there must be some additional value to taking up that option. On this basis, Three submits that there should be no circumstance under which Eir liberalises its licence without payment of an additional fee.

4.21 Three proposes that ComReg should consider giving Eir the opportunity to

surrender its 2.1 GHz spectrum which can then be re-awarded as liberalised spectrum. Three suggests that its proposal could also be extended to Three and Vodafone which could eliminate the requirement for time slices, licence extensions and allow for liberalisation of all the 2.1 GHz Band from the date of the award. However, Three suggests that if this was offered and Eir chose not to pursue it, then its current 3G licence should remain unchanged until its expiry.

- 4.22 Vodafone submits that the “*spectrum imbalance*” in the 2.1 GHz Band is a significant issue with respect to spectrum liberalisation. Vodafone suggests that while Three’s “*excess spectrum*” holding has not yet had a significant effect on the market, this is a timing issue only due to the work of merging the Three and O2 networks.
- 4.23 Vodafone submits that, in order to prevent significant competitive distortions in the market, ComReg should only introduce early liberalisation when the date for the auction has been fixed.

4.2.3 Time Slices in the 2.1 GHz Band

- 4.24 Eir suggests that an alternative approach would be to administratively assign 2x15 MHz of the 2.1 GHz Band to each of the MNOs and make the remaining 2x15 MHz available for auction. However, Eir concedes that, if all future rights of use in 2.1 GHz band are to be determined by auction, it would be necessary to apply two time slices.
- 4.25 Three disagrees with the time slice approach and suggests that it:
- creates artificial lots with durations that do not correspond to bidders demands;
 - would make the auction unnecessarily complex as there is no real demand in its view for short-term slices; and
 - is not needed as the situation is different to the 2012 MBSA as bidders have more flexibility to adapt to the loss of 2.1 GHz spectrum compared to 2012 when short term extensions may have been necessary to ensure 2G service continuity.
- 4.26 Three suggests that ComReg adopts two lot categories, one for licences starting when Vodafone’s and Three’s current licences expire (i.e. 2x45 MHz from 2022 to expiry) and the other for licences starting when Eir’s current licence expires (i.e. 2x15 MHz from 2027 to expiry). Three considers that this approach would negate the requirement for time slices and would make the award process simpler.
- 4.27 Vodafone does not support ComReg’s proposal on Time Slices suggesting that

an alternative to the two Time Slice design is desirable. In particular, it suggests:

- that the main factor driving uncertainty is the possibility of winning a different quantity of spectrum in each time slice;
- that the time slice proposal could cause more difficulty than in 2012 when durations across the two time slices in the MBSA were different, being approximately 2 and 15 years respectively;
- that the durations of the time slices proposed in this award would not give an operator sufficient opportunity to recover the cost of equipment investment; and
- that it is more difficult for operators to anticipate any change in demand in 2027 and bid appropriately for spectrum required at that later date.

4.28 Vodafone suggests that ComReg moves from two time slices to a single time period beginning on 1 June 2021 for all supra 1 GHz by offering existing licensees the opportunity to surrender their licences at this date. Vodafone argues that, while operators would lose the remaining value of the upfront payments made in respect to their current 3G licence, they would benefit by not having to pay any remaining SUFs attached to those licences.

4.2.4 Time slices in other bands

4.29 Eir does not consider it is appropriate or necessary to apply time slicing to the 2.3 GHz and 2.6 GHz Bands and considers that this approach would also introduce unnecessary complexity to the auction design. Eir also questions whether time-slicing the 2.3 GHz and 2.6 GHz Bands is compatible with the provisions of the European Electronic Communications Code (EECC) on licence duration.

4.30 Three submits that, if ComReg proceeds with the current approach, time slices should be restricted to the 2.1 GHz Band for a number of reasons. Three submits that:

- the 2.3 GHz and 2.6 GHz Bands are close substitutes for providing incremental network capacity and bidders should get the opportunity to bid for clean licences covering the maximum licence term.
- the 2.1 GHz Band is not as close a substitute for 2.3 GHz and 2.6 GHz Bands as they are for each other because the 2.1 GHz Band is a legacy mobile band;

- time slices introduce a risk that bidders bid strategically for packages that break up bands which they do not expect to win but which could be relevant to price determination; and
- adding time slices in the 2.3 GHz and 2.6 GHz Bands needlessly complicates the auction, requiring the use of package bidding and increasing the number of bid options which increases the risk of bidder error and strategic bidding.

4.31 Vodafone suggests that time slices should not be applied to other bands in this award process and ComReg has overstated the interchangeability of equipment across different bands. For example, Vodafone suggests that radio equipment currently has little flexibility to work in multiple bands and that dual band equipment is twice as expensive, meaning that operators would likely purchase band specific Base station Transceiver (BTS) equipment⁵⁶. This could limit switching between bands across time slices as the time slices are too short in its view to economically use equipment in spectrum unavailable in the other time slice.

4.32 Imagine questions the substitutability of the supra 1 GHz bands and suggests that ComReg has not demonstrated any justification for creating time slices for the 2.3 GHz and TDD portion of the 2.6 GHz band. Imagine argues that time slices are only needed for the 2.1 GHz band and extending them to the TDD bands is complex and could make investment in FWA services less attractive.

4.3 DotEcon's updated view

4.33 DotEcon's assessment of responses related to issues discussed in Chapter 5 of Document 19/59R are outlined below.

4.3.1 Licence alignment

4.34 DotEcon notes that ComReg's proposals regarding the calculation of Eir's fee for early liberalisation are consistent with its statutory obligations and stated objectives. If the auction determines that the market value of Eir's 2.1 GHz spectrum, when liberalised, is higher than its current fee, it will be required to pay that market value.

4.35 In relation to Three's suggestion that there was a difference in approach between determining fees for extending its licences and the methodology for determining liberalisation fees for Eir, DotEcon notes that it is important to recognise that there is a distinction between changing the conditions on a

⁵⁶ Alternatively operators could acquire such equipment via a technology license agreement, whereby an owner (licensor) of some technological intellectual property (such as BTS designs) sells to an operator (licensee) the right to use, change, or resell the technology.

licence already held by an operator through liberalisation, which would not represent giving something of self-standing value, and giving the operator something new, such as access to spectrum over a period in which it would not otherwise hold a licence. Therefore, the liberalisation of Eir's licence is not a comparable situation to Three paying for an interim licence to align its licence with Vodafone.

4.3.2 2.1 GHz Liberalisation

4.36 DotEcon suggests that, in the unlikely event that the price of 2.1 GHz rights of use is above the fee level currently being paid by Eir, it would be appropriate to charge a liberalisation fee based on the going market rate (i.e. in line with what operators are likely to be paying for the first 5 years of any new 2.1 GHz licences they are awarded).

4.37 Further, DotEcon is of the view that any fees charged to Eir for early liberalisation should be based on balancing a number of potentially conflicting principles, namely;

- i. as far as possible, not distorting Eir's incentives to liberalise.
- ii. ensuring that access to liberalised spectrum for Eir is not at unduly favourable terms that could distort downstream
- iii. as far as possible, preserving and not undermining, the rights and obligations established by the previous award of the 2.1 GHz spectrum.

4.38 In light of the above principles, DotEcon:

- considered that it appears unlikely that the price of the 2.1 GHz spectrum in this award will be above the fee level being paid by Eir for its existing licence;
- is of the view that allowing Eir to liberalise its current licences free of charge might give rise to a competitive distortion where it ends up paying less than other licensees for similar rights of use;
- the approach ensures that Eir pays the minimum amount necessary for the option to liberalise its licence subject to the requirement not to create competitive distortions by gaining access to liberalised spectrum below the market price;
- strongly disagrees with Three's proposal to potentially make Eir pay more than the market price for a number of reasons, including :

- efficiency considerations require that payments reflect the opportunity cost of other potential users not the value to the licensee itself.
 - making Eir pay in excess of a reasonable estimate of the current market price of 2.1 GHz spectrum is incompatible with providing incentives for the efficient assignment of the spectrum; and
 - If Three was to pay the entire benefit of liberalisation there is a good chance this would result in Eir paying in excess of a reasonable estimate of the current market price of 2.1 GHz spectrum which is incompatible with the principle that spectrum fees should reflect the need to ensure the optimal use of spectrum.
- it would not be appropriate to give Eir a rebate on the fees for its current licence, even if prices for new 2.1 GHz licences awarded are lower because:
 - it would undermine the outcome of the previous award;
 - it would set a poor precedent for future awards. If these payments are not binding, bidding incentives for future awards could be distorted through expectations that the State would similarly underwrite the risk of the spectrum in the future; and
 - any potential additional payment for liberalisation would be made in consideration of its exercise of the option to liberalise its licence, not as a correction for any change in the asset value of the original un-liberalised licence.
- 4.39 DotEcon also notes that under ComReg's proposals Option 2A refers only to the point at which ComReg makes the liberalisation option available. Licensees have discretion as to when, if at all, they exercise this option. It remains appropriate for ComReg to proceed with Option 2A.
- 4.40 DotEcon notes that including both time slices in the calculation of any liberalisation fee reduces the incentive for competitors to bid up the price of Time Slice 1 in order to impose additional costs on Eir.
- 4.41 DotEcon does not agree that it is inappropriate to use the difference between the award prices and Eir's current fees to establish the liberalisation fee noting, among other things, that the argument for charging Eir a liberalisation fee is not that it should pay the value of liberalisation, but that it should be expected to pay an amount that is in line with what other licensees are paying for their 2.1 GHz licences with liberalised rights of use.
- 4.42 In relation to Eir's request for an explanation of how the price of its current

licence was calculated, DotEcon notes that the prices provided in its previous report are those that came from the benchmarking exercise which included TDD rights of use. This was a hypothetical exercise to demonstrate that an additional fee for liberalisation was unlikely. Any actual fee would be determined only on the basis of Eir's current fees for its 2.1 GHz FDD spectrum. DotEcon has now provided a more relevant benchmark on the basis of Eir's current fees for its 2.1 GHz FDD rights of use only. (See Annex B – DotEcon Report – Document 19/124a).

4.3.3 Time Slices in 2.1 GHz Band

4.43 DotEcon notes that the inclusion of the 2.1 GHz Band necessitates time slicing for that band assuring Eir continues to hold its existing licence for the remainder of the term (i.e. up to 2027).

4.44 In relation to Eir's suggestion that an administrative award is appropriate, DotEcon is of the view that:

- it is not appropriate to give existing licensees any preferential treatment or claim to the spectrum simply by virtue of their incumbency;
- other potential users should be given the opportunity to compete for the spectrum on offer to ensure an efficient outcome and to prevent possible competitive distortions to competition through favouring particular users over others; and
- Eir has access to 2x15 MHz of the 2.1 GHz spectrum until 2027 (i.e. 7 years beyond the expected timing for the award of new licences), a factor not enjoyed by any other operator which should offer sufficient time to address any business continuity concerns that may arise.

4.45 In relation to Three's proposal to have two lot categories, DotEcon notes that only Eir would be interested in the shorter licences and this situation would be common knowledge amongst bidders. This would expose the award to certain risks.

- It becomes simple for bidders to segment their demand (i.e. Eir for the 3 shorter licences and Vodafone and Three across the 9 longer licences) and avoid competition by tacit collusion.
- Other bidders may attempt to artificially bid up the price of the shorter licences, with the aim of either maximising the amount Eir would need to pay or restricting Eir's spectrum holdings over the longer term.

4.46 Consequently, DotEcon is of the view that time slicing is by far the superior approach.

- 4.47 In relation to suggestions that time slices would not be needed if licensees surrendered their licences, DotEcon notes that allowing MNO's to hand back their 2.1 GHz spectrum licences early, as suggested by Vodafone and Three, might be a viable option and could help to simplify the award. DotEcon considers that it may be prudent to explore the possibility of whether licensees would be willing to hand back existing licences. If this option is considered, any commitments to give up existing licences would need to be made sufficiently early, to allow for bidders to take account of the implications for the award and prepare accordingly.
- 4.48 DotEcon notes that if all three MNOs were to hand back their licences on a common date it would allow for new 2.1 GHz licences to be completely aligned across the whole band avoiding the need to offer interim rights and remove the need for time slicing. Alternatively, if only Three and Vodafone surrendered their licences it could still simplify the award by removing the need for licence alignment thereby allowing new rights of use to start earlier.
- 4.49 In that regard, DotEcon considers it prudent to explore the possibility or whether there would be sufficient interest in the above options.

4.3.4 Time Slices in other bands

- 4.50 In relation to concerns from respondents that time slicing in other bands is not necessary, DotEcon notes that if time slicing is to be used for the 2.1 GHz Band it remains of the view that it is necessary to time slice all of the higher frequency bands in order to, amongst other things, minimise gaming opportunities and maximise switching opportunities. In particular, if Eir wishes to bid for an amount of spectrum that is within 30 MHz of the overall cap, it would be forced to include bids for 2.1 GHz spectrum in Time Slice 2.
- 4.51 DotEcon notes that it is important for efficiency that the award format chosen allows bidders to switch easily between bands. Further, time slicing the 2.3 GHz and 2.6 GHz Band is also desirable from the perspective of protecting Eir from gaming and to allow it to maximise its switching opportunities. This could also leave it open to strategic bidding aimed at artificially increasing the price of 2.1 GHz lots in Time Slice 2 (See Annex A – DotEcon Report, Document 19/124a).
- 4.52 In relation to concerns expressed by respondents that 2.3 GHz and 2.6 GHz are not direct substitutes for 2.1 GHz, DotEcon notes that the 2.1 GHz, 2.3 GHz and 2.6 GHz bands all have similar propagation characteristics, and even if they are currently not currently close substitutes, in the longer term they are all likely to be used as capacity bands for hybrid 4G/5G services. This is particularly important in light of ComReg's proposals to extend licence duration to circa 20 years.

- 4.53 In relation to concerns surrounding perceived complexity, DotEcon notes that the increase in complexity from the proposed time slicing in reality is likely to be minor in an auction format that allows for package bidding. Further, DotEcon notes that, with package bidding, bidders have the option to only submit bids that would give them licences that span the full licence period without facing aggregation risk of winning spectrum in only one of the time slices. In such a case bidders do not even need to value the spectrum for the two time slices separately but can ignore the time slicing and only bid for packages that give the same licenses over the full 20-year period.
- 4.54 Finally, DotEcon notes that the concerns of Vodafone (that the time slices are not long enough to allow a sufficient return on investment) and Three (that the time slices do not match up with bidders' demands) effectively dissipate if a bidder never bids for (and therefore can never win) combinations of lots that are unprofitable/undesirable. Package bidding means that bidders can only be awarded a licence that they view as too short if they have explicitly submitted a bid for it.

4.4 ComReg's assessment of submissions

4.4.1 Licence period alignment

- 4.55 ComReg's assessment of licence period alignment is set out in Annex 7.

4.4.2 Early Liberalisation

- 4.56 ComReg assesses the responses in relation to early liberalisation under the following headings.
- Timing of liberalisation;
 - Issues related to liberalisation fees; including
 - 2.1 GHz valuation change since previous award
 - Liberalisation fee methodology
 - Benchmark calculation
 - When a liberalisation fee is required
 - Rebate
 - Competitive distortions.

Timing of liberalisation

- 4.57 ComReg's preferred option in the draft '2.1 GHz Band Liberalisation' RIA was Option 2A - to provide the option for all existing licensees to liberalise some or

all existing 2.1 GHz rights of use from the time of the substantive decisions concerning the present Proposed Award.

- 4.58 Eir appears to have misconstrued ComReg's proposal, which does not set a definite decision date for the liberalisation of existing licences.
- 4.59 Under Option 2A, licensees would have the option to liberalise at any time following the substantive decision. Licensees would not be required to liberalise at a particular time, but the option to liberalise would be available following the substantive decision. Alternatively, under Option 2B liberalisation would be available following the assignment of new rights of use. The difference between Option 2A and Option 2B concerns from when the option to liberalise would become available rather than when liberalisation would actually take place. Under both options the decision on when to apply for liberalisation would remain at the discretion of licensees.
- 4.60 ComReg also notes DotEcon's updated advice that ComReg should proceed with Option 2A as it avoids constraining licensees to wait longer than necessary to migrate away from legacy 3G use and Eir would be free to avoid any uncertainty over fees by choosing to liberalise after the award.
- 4.61 Therefore, in response to Eir, ComReg confirms that the liberalisation option may be exercised at the licensee's discretion at any point from when the option becomes available.
- 4.62 In relation to Vodafone's view that ComReg should only introduce early liberalisation when the date for the auction process has been fixed to prevent competitive distortions, ComReg notes that under Option 2A licensees would have the option to liberalise at any time following the time of the substantive decisions concerning the present Proposed Award. The specific timing of the award process would be published in the Information Memorandum (IM) in due course after those decisions.⁵⁷
- 4.63 In that regard, ComReg notes that it is not necessary to delay liberalisation until the publication of the Final IM as ComReg is already of the preliminary view that no competitive distortions would arise from providing the option to liberalise at any time following the substantive decisions, which would occur earlier than publication of IM. In particular, in the draft 2.1 GHz Band Liberalisation RIA, ComReg concluded that liberalisation at the earliest possible opportunity (i.e. at the time of the substantive decision (Option 2A)) would not create competition concerns. Therefore, ComReg is of the preliminary view that it is not necessary

⁵⁷ Draft timelines would be available in the draft IM which would be published before the Final Decision. In the 3.6 GHz Award, the time period between the publication of the substantive decision and the Final IM was approximately 6 weeks.

to delay the option to liberalise until the publication of the IM.

Liberalisation Fees

4.64 At the outset, ComReg would note that a liberalisation fee would only be necessary if the prices achieved in the award for 2.1 GHz rights of use exceeded the current fees being paid by Eir noting that the benchmarking data indicates that the price of the 2.1 GHz liberalised spectrum in the award is likely to be less than the fees for the current 3G licences that were set in 2002/2007. ComReg assesses the various issues in relation to fees below.

2.1 GHz valuation change since previous award

4.65 In relation to Eir's concern that ComReg's fee proposal would reflect the value of liberalisation but also any other changes in value unrelated to liberalisation, ComReg agrees with the views of DotEcon and in particular that the amount due should reflect what other licensees are paying for their 2.1 GHz licences⁵⁸ rather than the value of liberalisation to Eir.

4.66 DotEcon notes that the argument for charging Eir a liberalisation fee is not that it should pay the entire increase in value of currently held spectrum due to liberalisation, but that it should be expected to pay an overall amount for spectrum access that is broadly in line with what other licensees are paying for their liberalised 2.1 GHz licences over the first time slice.

4.67 Further, the purpose of this process is not to set a new price for Eir's existing licence at this point but only to set a reasonable additional charge for liberalisation. ComReg is of the view that such an approach is necessary in order to avoid any distortions to competition which might be created by Eir using liberalised rights of use at price below what is being paid by its competitors (Vodafone and Three) (See also Annex 8 'Liberalisation RIA').

4.68 While incumbents would likely have a value related to 'continuity of service/migration', the prices paid at commencement of current licences were likely informed by the unavailability of other bands which is not a factor in the Proposed Award. Further, in relation to continuity of service, all affected operators would have time to migrate to other bands as 2.1 GHz rights of use do not expire until 2022 (Vodafone & Three) and 2027 (Eir). As noted by Three, existing licensees have more flexibility to adapt to the loss of 2.1 GHz spectrum compared to 2012 when short term extensions may have been necessary to ensure 2G service continuity. Such bidders also have significant spectrum holdings in other bands so issues regarding continuity of service driving value of 2.1 GHz rights of use, if any, are likely to be limited.

⁵⁸ The opportunity cost.

Liberalisation fee methodology

- 4.69 In relation to Eir's concerns around the use of both time slices to determine the price, ComReg notes and agrees with DotEcon's view that using this overall price point covering both time slices (rather than just considering one of the two time slices) helps to minimise incentives for other bidders to seek to manipulate the liberalisation fees and impose additional costs on Eir.
- 4.70 In effect, the use of two time slices to determine the liberalised fee prevents bidders (who would be bidding across both time slices) from attempting to artificially increase Eir's liberalisation fee by pushing up the price of the 2.1 GHz Time Slice 1 lots. In effect, other bidders would have information about an aspect of another bidder's demand providing it with an opportunity to bid strategically. Such an approach risks an inefficient award and increases the likelihood that a liberalisation fee would be charged undermining Eir's incentive to liberalise. Using the combination of prices across the two time slices helps to mitigate this risk as attempts to increase the liberalisation fee would require pushing the price in both Time Slices and bidding above valuation for the package. In that regard, using both time slices is appropriate to determine any liberalisation fees and prevent perverse incentives and potential distortions to the award process.
- 4.71 Therefore, ComReg remains of the view that using both time slices to determine any liberalisation fees is appropriate in order to discourage strategic bidding aimed at imposing an additional cost on Eir.
- 4.72 In relation to Eir's claim that the 3.6 GHz approach to issuing refunds is irrelevant to liberalisation of the 2.1 GHz Band, ComReg notes that the proposed methodology used to estimate the liberalisation fee is based on the methodology used to calculate the refunds to 3.6 GHz licensees, including Eir. In effect, the methodology proposed for determining the liberalisation fee has been used successfully in estimating the price of specific lots which are part of an overall package. Therefore, ComReg considers this methodology to be appropriate.

Benchmark calculation

- 4.73 In relation to Eir's request for an explanation of how the price of its current licence was calculated, ComReg notes the views of DotEcon that the reported prices for the previous 2.1 GHz awards in Ireland are from the benchmarking exercise. These price points were determined by taking the prices achieved in the respective awards (including SUFs) and running them through the same standardisation method applied to all award prices during the benchmarking exercise. The price point corresponding to the licence awarded to Eir in 2007 was calculated in a manner to be comparable with the benchmark data and is

not (and was never intended to be) the starting point for determining any liberalisation fees to be paid by Eir. However, in order to assist Eir in its determination of whether and when to liberalise its 2.1 GHz holdings. DotEcon has provided an updated calculation which is the price that would be used to determine whether a liberalisation fee is required or not.

- 4.74 Annex B of the DotEcon Report (Document 19/124a) sets out the detailed approach to calculating whether Eir would be required to pay a liberalisation fee, and in the event that it did, the amount to fall due (based on currently available information). In summary, the provisional price for a 2x5 MHz block based on the fees paid by Eir for its current licence (in 2019 terms and adjusting for licence duration to match the two time slices taken together) is **€31,655,826**. Depending on the outcome of the award, if the estimated price of a newly awarded 2x5 MHz 2.1 GHz licence were to exceed the duration adjusted price paid by Eir for a 2x5 MHz licence based on its current licence fees (i.e. €31,655,826), a liberalisation fee would be applicable should Eir choose to liberalise its licence at any point before expiry.
- 4.75 These estimates will be updated prior to the publication of ComReg's substantive decisions on the award to account for, among other things, changes to the CPI and a new WACC (should a new figure be adopted prior to the publication of the substantive decisions). However, ComReg notes that while the liberalisation option may be exercised at the licensee's discretion no further updates to the value of Eir's current licence would be made following the point when the option to liberalise becomes available (i.e. the time of the substantive decision). Therefore, while the liberalisation option may be exercised at the licensee's discretion, the price point relating to Eir's current licence would be locked down at the time of the substantive decision and not change regardless of when Eir decides to liberalise.

When a liberalisation fee is required

- 4.76 In relation to Three's view that there should be no circumstance under which Eir liberalises its licence without payment of an additional fee, ComReg agrees with DotEcon that there is no valid argument for making Eir pay more than the market price. ComReg notes that the value of the spectrum at the time of the award (including impact of liberalisation) would be determined by the award process. If the value of liberalised 2.1 GHz rights of use following the award process is the same as or below what Eir is currently paying for un-liberalised rights of use there would be no basis for Eir paying an additional amount since it would already be paying at or above the value of the spectrum at the time of the award. In particular, if Eir was required to pay more than the market value of the spectrum in order to liberalise, it may decide not to liberalise, or even if it did, it is likely to be paying in excess of the likely opportunity cost of the spectrum, thereby creating perverse incentives including incentives to vacate this

spectrum at a point in the future.

- 4.77 Finally, ComReg notes that Three had no objections to Vodafone and Three liberalising their rights of use early without a fee where the issues it raises would appear to also apply, even if over a shorter period.

Rebates

- 4.78 In relation to Eir's submission that it should receive a rebate on its existing fee if the liberalised price was below the existing fee, ComReg agrees with the views of DotEcon that it would be inappropriate to give Eir a rebate as this would undermine the outcome of the previous award if these payments are not binding and bidding incentives for future awards could be distorted. In particular, ComReg notes that:

- Eir's licences were acquired by it in full knowledge of the fees that would be charged and with the possibility that the value of those licences could fluctuate over time.
- offering a rebate on licence fees to reflect the implied change in value could have a highly undesirable effect on the efficiency of future award processes if payment terms were seen as subject to change and non-binding. For example:
 - Providing rebates rights prior to the end of existing licences would undermine the integrity of the previous award process and create a risk of bidders over valuing spectrum in this award if there is a possibility of licence rebates in the future.
 - It could result in the holders of rights of use of spectrum, in general, advancing future claims for rebates if they were of the view that the value of such rights of use have fallen.

- 4.79 Therefore, ComReg is of the preliminary view that rebates to Eir would not be appropriate if the value of liberalised right of use was below the existing fee structure,

Competitive distortions

- 4.80 In relation to Vodafone's view that Three's excess spectrum holdings have yet to have a significant effect but may do so in the medium or long term, ComReg notes that its assessment of the competitive impact in the draft '2.1 GHz Liberalisation' RIA concerned the time between the two options to liberalise (Option 2A and Option 2B) and the expiry of Three's 2.1 GHz rights of use only. ComReg was of the preliminary view that liberalisation of all rights of use was unlikely to confer a material advantage on Three over those periods. ComReg's views were informed by a number of factors listed in Para 6.58 of Document

19/59R (of which Three's relative performance to other bidders including Vodafone was one factor). For the avoidance of doubt, any impacts beyond the expiry of Three's 2.1 GHz rights of use (in the medium or long term) were not assessed.

4.4.3 Time slices in 2.1 GHz

- 4.81 ComReg agrees with DotEcon's view that the inclusion of the 2.1 GHz Band necessitates time slicing absent Eir surrendering its licences which, as noted below, seems unlikely to occur given the payments that would still be due by Eir.
- 4.82 In relation to concerns raised by Three and Vodafone regarding the duration of time slices, ComReg notes that while the durations of the time slices are different to the 2012 MBSA, this should not require bidders to make bids in a different way when expressing demand for spectrum⁵⁹ if a CCA format is used. The CCA requires bidders to express demand in terms of packages of lots. As noted by DotEcon, bidders are free to effectively ignore the time slicing and only bid for packages that include the same combination of lots over the full 20-year period as was proposed.
- 4.83 Therefore, bidders do not need to consider the value of licences over only one of the time slices unless that would be of interest; a bidder would only be assigned rights of use in one time slice (but not the other) if it explicitly expresses demand for spectrum in that time slice only. Therefore, there is no necessity for any bidder to value spectrum separately for each time slice if its intention is only to acquire spectrum rights of use across both. For this reason, ComReg also considers that these proposals are consistent with the requirements of the yet to be transposed EECC, as time slicing is being used as a device to assign spectrum efficiently over the long term in a situation where current licences do not terminate at the same time. Bidders would be free to obtain rights of use for the full duration and would only be assigned lots of shorter duration if it made bids for same.
- 4.84 Similarly, in relation to concerns raised by Vodafone, a bidder could only be assigned different quantities of spectrum across both time slices by bidding for such a package. Concerns related to the returns on investment from winning rights of use in only one time slice fall away if a bidder's preference is to have rights in a band across two time slices and that is reflected in its bidding approach. For example, Vodafone would win rights of use in one time slice only if it explicitly bid for a package that included spectrum only in that time slice.

⁵⁹ It should also be noted that ComReg now proposes that the duration of rights of use will be set at 20 years (See Section 5.3).

- 4.85 Three proposes to make 2.1 GHz spectrum available in two lot categories.
- The first lot category would consist of 9 lots (October 2022 – June 2040)
 - The second lot category would consist of 3 lots (March 2027 – June 2040)
- 4.86 ComReg agrees with the views of DotEcon that because only Eir would likely be interested in the shorter licences, this situation would be common knowledge amongst bidders, and exposes the award to (i) the risk of tacit collusion and (ii) strategic bidding.
- 4.87 In relation to (i), ComReg notes that such an approach would not be appropriate as it would fragment demand across two lot categories of different duration softening competition during the award. The second lot category is only likely to be of relevance to Eir given that its existing rights of use are licenced up to the commencement of that lot category.⁶⁰ This creates obvious incentives for tacit collusion to occur with operators not competing too intensely, or at all, in both lot categories as it risks driving up prices for all bidders in both categories.
- 4.88 Further, Vodafone and Three are unlikely to have strong demand for 2.1 GHz rights of use that would commence in 2027 given that their current rights of use expire in 2022. Indeed, both respondents' objections to time slicing the 2.1 GHz Band suggests that Three and Vodafone have demand for 2.1 GHz rights of use from the expiry of their existing rights of use for the full duration of the licence. In effect, demand for 12 lots would be fragmented across two lot categories (one lot category with 9 lots and the other with 3 lots) which would soften competition as certain bidders are only likely to compete for rights of use in one of the two lot categories. Alternatively, under ComReg's proposal, all bidders would compete for all 12 2.1GHz lots at the same time.
- 4.89 In relation to (ii), ComReg notes that Eir will likely have predictable demand for the second lot category and other bidders may artificially bid up the price of that lot category with the aim of increasing the prices Eir would need to pay (or restrict Eir's holdings in the longer term) while bidding more straightforwardly in other bands. Alternatively, under ComReg's time slicing proposal an individual bidders demand is far less predictable because multiple bidders are likely to have a different interest across a variety of lot categories and compete on that basis.
- 4.90 In that regard, ComReg is conscious that Three's proposals create unnecessary risks to competition unlike the proposals set out in Document 19/59R which

⁶⁰ As noted by DotEcon, it would seem reasonable to expect Eir would have the most natural interest in those licences to maintain its spectrum holdings in the 2.1 GHz bands beyond the expiry of its current licence.

obviate remove such risks while allowing all bidders to compete for all spectrum rights of use on an equal basis.

- 4.91 In response to Eir's suggestion to administratively assign 2.1 GHz rights of use, ComReg outlines in its draft 'Assignment Process' RIA why it is of the view that this approach is not appropriate. ComReg also notes that Eir accepts the requirement for time slices in the 2.1 GHz Band if the band is included in the award.

4.4.4 Time Slices in 2.3 GHz and 2.6 GHz

- 4.92 This section is divided into two parts.

- Summary of Annex A (Document 19/59a) – Time Slicing
- Assessment of responses to Document 19/59R

Annex A Time slicing

- 4.93 Prior to assessing the views of respondents, ComReg notes that Annex A of the DotEcon Report (Document 19/59a), which informed ComReg's consideration of time slices, was redacted as DotEcon was concerned that elaborating on the potential for gaming behaviour might be unfair to Eir. However, given that Eir does not appear to have recognised certain issues associated with the need for time slicing the other bands itself, DotEcon considers that it is now preferable if the rationale for time slicing all the supra-1GHz bands is set out transparently. Therefore, ComReg is of the view that it is now appropriate to publish that Annex as part of this response to consultation in order to provide stakeholders with appropriate information to inform their considerations.
- 4.94 Annex A sets out DotEcon's full consideration of these matters. However, in summary, since Eir's spectrum holdings would differ between the two time slices, the amount of spectrum it can bid for in each of the time slices would also differ due to the application of competition caps (i.e. Eir would be allowed bid for 30 MHz more in Time Slice 2 compared to Time Slice 1 because it would have 30 MHz in Time Slice 1.)
- 4.95 Therefore, if only the 2.1 GHz Band was time sliced (and all other bands are awarded for a single licence term covering the total duration of Time slice 1 and Time slice 2), in order to have total holdings at the end of the award at the cap, Eir would need to bid for at least 30 MHz of the 2.1 GHz spectrum for Time Slice 2. Alternatively, if the other bands are time sliced it would have the option of obtaining additional spectrum in Time Slice 2 in multiple different bands, noting that the relative prices of different bands is likely to vary over the duration of the award

- 4.96 For example, given the proposed cap of 375 MHz (See Chapter 6) Eir would be able to bid for 190 MHz of spectrum covering Time Slice 1, and 220 MHz of spectrum covering Time Slice 2 taking into account of its current holdings. If Eir wished to increase its holdings up to the cap (and obtain an additional 220 MHz in Time Slice 2) then the only available option for making up the additional 30 MHz for Time Slice 2 would be to bid for 2.1 GHz spectrum in that time slice (since the other bands would not be time sliced).⁶¹ This would remove flexibility for Eir to switch from one band to another during Time Slice 2 if it was attempting to obtain additional spectrum rights of use. In particular, relative prices might make it desirable for Eir to switch demand away from the 2.1 GHz band and into the 2.6 GHz or 2.3 GHz Bands.
- 4.97 Further, since the other bidders would know the restrictions faced by Eir in the 2.1 GHz Band, there may be an opportunity for other bidders to bid for the 2.1 GHz Time Slice 2 lots with the sole aim of artificially driving up prices in order to either:
- make Eir pay as much as possible for the spectrum; or
 - force Eir to reduce its demand to put it at a disadvantage (in terms of spectrum holdings) in the downstream market.
- 4.98 Time slicing all of the higher frequency bands removes this risk as Eir could switch away from 2.1 GHz in response to relative price changes. In effect, while time slicing across all bands provides all bidders with flexibility to compete across all spectrum bands, it is particularly relevant for Eir given it would be the only bidder with existing spectrum holdings in Time Slice 1.

Assessment of responses to Document 19/59R

- 4.99 Notwithstanding the above, respondents expressed a number of concerns in relation to Time Slices. ComReg assesses these concerns under the following headings
- Complexity;
 - Substitutability; and
 - Strategic bidding.

Complexity

- 4.100 ComReg agrees with DotEcon's view that any additional complexity created as a result of times slices is minor relative to the benefit of including time slices and

⁶¹ Making up the difference using other bands would not be possible without violating the competition cap in time slice 1.

in any case, the additional complexity primarily resides with the auctioneer rather than the bidders. Package bidding allows for operators to bid for lots in both time slices in combination rather than bid for them separately hence avoiding aggregation risk. ComReg previously addressed concerns in relation to complexity in Document 19/59R (para 3.82 – 3.84) and was of the view that time slices in other bands do not create unnecessary complexity for bidders in the award design.

- 4.101 In particular, ComReg notes that, where a bidder wishes to bid across the now full 20 year duration the two time slice approach involves no more complexity than the requirement to bid on a given lot in both time slices rather than one. Further, as noted earlier given the use of package bidding there is no risk of bidders winning a subset of those lots.

Substitutability

- 4.102 In relation to substitutability between the 2.3 GHz, 2.6 GHz and 2.1 GHz Bands, ComReg agrees with DotEcon that these bands will likely become more substitutable in the future⁶² even if there are current differences. While the 2.1 GHz band is a legacy mobile band and the other bands are all entirely greenfield, all bands are likely to be used to provide similar services in the longer term and legacy usage will become less relevant. In that regard, given that a licence duration of 20 years is now proposed, ComReg is of the view that applying time slices across other bands is all the more relevant and is in line with a spectrum management policy that promotes long run efficiency effects arising from spectrum awards. In providing for this objective, ComReg notes that this does not provide significant additional complexity for bidders (see complexity above).
- 4.103 Three notes that “*Although 2.1 GHz is an alternative band for network capacity, for various reasons it is not as close a substitute for 2.3 GHz and 2.6 GHz as the other two are for each other.*” However, ComReg notes that its views in relation to substitutability and time slices do not presume an exact characterisation of the relative substitutability of different bands. The magnitude of the level of competition in these bands is necessarily uncertain. However, given that these bands are used for broadly similar uses, allowing substitutability between 2.1 GHz spectrum and those other bands within the auction provides a level of flexibility within the auction that will facilitate a broad range of bidding behaviour and outcomes that are beneficial in ensuring that the resulting spectrum allocation across bands is efficient. This would allow maximum flexibility in terms of switching between the higher frequency lots within the award, which should help to facilitate an efficient assignment. As

⁶² For example, all bands can be used to provide 5G services in the future.

noted by DotEcon, it is important for efficiency that the award format chosen allows bidders to switch relatively easily between the three higher frequency bands as relative prices evolve.⁶³

- 4.104 For example, even if a bidder prefers the 2.1 GHz Band to those other bands, such a bidder might be prepared to switch from the 2.1 GHz Band to the other bands in response to a sufficiently large price differential between the bands. That is, beyond certain prices, bidders may regard spectrum in the available bands as substitutable with regard to fulfilling the remainder of their spectrum requirements. In particular, ComReg observes that the minimum price of the 2.1 GHz Band (at the time of writing) is five times higher than the 2.3 GHz or 2.6 GHz Band. Depending on competition during the award, bidders may decide to switch from or to lots in the 2.1 GHz band.

Strategic bidding

- 4.105 ComReg disagrees with Three's view that the current proposal introduces a risk that bidders could strategically bid for packages they do not expect to win in order to influence prices. In Section 7.3.2 of ComReg Document 19/59R, ComReg discussed in detail gaming risks that may arise in the Proposed Award. ComReg does not propose to repeat that assessment here but notes that the CCA mitigates against this particular risk because all bids are binding and all are potentially winning bids. A bidder that bids strategically for lots it would prefer not to win with a view to affecting rivals' winning prices faces the real risk that it ends up winning these lots. Further, the likelihood of such strategies being used depends more on the degree of information certain bidders have about other bidders' demand, information which should not be readily available to bidders under ComReg's proposals.
- 4.106 For example, the activity rules in the CCA would reduce scope for strategic bidding by limiting the bids that bidders can make in light of choices made by bidders in earlier clock rounds. These activity rules have been designed to discourage bids that do not reflect valuations, as doing so could lead to a situation in which bidders cannot express their true preferences in the supplementary bids round. As such, ComReg considers that the current proposal minimises the risk of this undesirable type of bidding behaviour. Alternatively, ComReg previously addressed Three's two lot category proposal which provided information about other bidders demand (i.e. Eir would have predictable demand for the second lot category raising the possibility of strategic bidding).
- 4.107 More generally, the possibility of gaming due to time slices is limited by a number of notable restrictions on bidders. For example, competition caps,

⁶³ DotEcon Assessment of Responses (Document 19/124a) p17.

limited transparency and activity rules are designed to promote straightforward bidding. Indeed, one of the reasons for imposing time slices in the 2.3 GHz Band and 2.6 GHz Band is to guard against the risk of gaming as outlined in Annex A of the DotEcon Report (Document 19/124a). Indeed, ComReg notes this risk is greater due to the asymmetry in Eir's existing holdings across the two time slices. In that regard, ComReg notes Three's support for Eir's 2.1 GHz existing spectrum counting towards the cap in Time Slice 1.

4.4.5 Alternatives for assigning 2.1 GHz rights of use.

4.108 In response to Document 19/59R, both Vodafone and Three suggest that the need for Time Slices would be removed if all existing Licensees surrendered their 2.1 GHz Licences. In that regard, ComReg agrees with DotEcon that allowing MNO's to hand back their 2.1 GHz rights of use early might be a viable option and could help to simplify the award. ComReg observes that such a scenario would remove the requirement for licence period alignment, early liberalisation and time slices in the Proposed Award.

4.109 However ComReg respects that the surrender of existing licences is a matter for each licensee to consider in its own right. In that regard, ComReg notes the following relevant considerations.

- Vodafone and Three have no outstanding Spectrum Access Fees. Spectrum Usage Fees would not be due, from the date of surrender, in the event of either party surrendering its licence.
- Eir has considerable spectrum access fees which fall due between now and March 2022 and these fees would remain payable in the event of it surrendering its licence. Although, the remaining spectrum usage fees would not fall due from the date of surrender.

4.110 In light of the above, ComReg notes that Vodafone and Three may be willing to surrender their respective licences in order to remove the current requirement for time slices and licence alignment given that the surrender of their licences could be done at no cost from a fees perspective to either licensee (as future SUFs would not be due and SAFs have already been paid).

4.111 However, the attractiveness of this option to Eir may be somewhat more limited as Eir would still be required to pay its Spectrum Access Fees for the full duration of its licence (which would still have circa 7 years remaining). In the absence of Eir surrendering its licence, time slices would always be required regardless of whether Vodafone and/or Three surrender their licences.

4.112 Notwithstanding, ComReg notes that, should Vodafone and Three both be willing to surrender 2.1 GHz rights of use, even if Eir does not, this would

usefully remove the need for Three's licence alignment and potentially allow new rights of use to begin earlier than currently envisioned. ComReg notes that there are various other possible scenarios depending on which licensees would surrender their licences. In that regard, only either (i) all three licensees surrendering their licences or (ii) both Three and Vodafone surrendering their licences could materially streamline the award process without compromising its effectiveness.

4.113 As noted above, these are matters for existing licence holders and ComReg would assess any proposals for the surrendering of licences on their merits. Parties, whether all licensees, or Three and Vodafone only, should jointly notify ComReg of any intention to surrender 2.1 GHz rights of use and provide a binding commitment from each licensee that, singularly and combined, addresses the timing issue and certainty issue on the surrender of such rights of use, including the time period over which such a surrender would occur (i.e. a common start date for new 2.1 GHz licences). In that regard, ComReg would remind all licensees of their obligations under competition law and, in particular, Sections 4 and 5 of the Competition Act 2002.

4.114 Finally, ComReg also agrees with DotEcon that any commitments to give up existing licences would need to be made sufficiently early, to allow for bidders to take account of the implications for the award and prepare accordingly. Therefore, in order to consider any proposals received from licensees and give effect to same in a timely manner, ComReg would need to have received notice of a binding commitment between relevant parties by a time no later than the closing date for submissions to this consultation (i.e. by 12 noon on 10 February 2020).

4.5 ComReg's updated position

4.115 Having taken into account the views of respondents and absent receiving any indication of willingness to surrender existing 2.1 GHz rights of use in accordance with the above, ComReg intends to proceed with its current proposals as described in this document and Document 19/59R.

Chapter 5

5 Key aspects of the Proposed Award Spectrum

5.1 This chapter discusses key aspects of the spectrum rights of use proposed to be awarded in the Proposed Award and in particular:

- the proposed grant of a limited number of individual rights of use in respect of the Proposed Bands, where such individual rights would be national in scope;
- the proposed band plans and compatibility considerations; and
- the proposed duration of the spectrum rights that would be awarded.

5.2 While the above issues will ultimately inform the conditions that would be attached to the spectrum rights that would be awarded (discussed in Chapter 7 below), certain aspects of these issues are discussed here as they also inform the discussion of the award type and format which follows in Chapter 6.

5.1 Limited number of individual rights on a national basis

5.1.1 Summary of ComReg's view in Document 19/59R

5.3 In Section 6.1 of Document 19/59R, ComReg proposed to grant individual rights of use for radio frequencies, in accordance with Regulation 9(2) of the Authorisation Regulations, in respect of each of the Proposed Bands because it would be necessary to, among other things:

- avoid harmful interference;
- ensure technical quality of service; and
- safeguard the efficient use of the relevant spectrum rights.

5.4 Further, ComReg considered that limiting the number of individual rights of use for radio frequencies in respect of each of the Proposed Bands was appropriate, having regard to Regulation 11 of the Authorisation

Regulations.⁶⁴

5.5 ComReg also proposed in Document 19/59R that the rights of use in respect of each of the Proposed Bands should be for the entire State.⁶⁵ This proposal was informed by a number of factors which included:

- the Proposed Bands are identified by the International Telecommunications Union (“ITU”) for International Mobile Telecommunications (“IMT”)⁶⁶ which, together with technical harmonisation standards⁶⁷, have resulted in large numbers of mobile devices being available for use in these bands, making them particularly suitable for the deployment of mobile broadband networks, which are typically deployed across the whole State;
- where these bands have been awarded by other Member States they have been awarded almost universally at a national level⁶⁸; and
- unlike the 2012 MBSA, the 3.6 GHz Award included national and sub-national rights of use. However, the particular factors which informed ComReg’s approach in the 3.6 GHz Award⁶⁹ do not arise for this award process. In particular:
 - (i) the previous licensing scheme in the 3.6 GHz Band entailed local area licences with a radius of 20km leading to many local single area licensees, but where the majority of the existing users of the band prior to the 3.6 GHz Award were regional operators;
 - (ii) while both mobile and fixed wireless broadband were identified as the likely uses of the 3.6 GHz Band in Ireland, ComReg observed that mobile would be of particular benefit in urban hotspot areas while fixed wireless would be particularly suited to rural deployments; and

⁶⁴ ComReg set out in paragraph 6.4 of Document 19/59R the reasons for this view.

⁶⁵ This is without prejudice to ComReg applying certain restrictions / coordination mechanisms on the geographic deployment of services with an aim to ensuring the compatibility between new and existing services.

⁶⁶ At the International Telecommunications Union (ITU) level the Proposed Bands have been identified for International Mobile Telecommunications (IMT), 700 Duplex (Article 5.317A), 2.1 GHz Band (Article 5.388), 2.3 GHz and 2.6 GHz Bands (Article 5.384A)

⁶⁷ At a regional level such as at CEPT level and EC level in Europe.

⁶⁸ 700 MHz Duplex rights have been awarded nationally in all European countries including: France, Germany, Finland, Italy and Switzerland; 2.1 GHz Band rights have been awarded nationally in all Member States; 2.3 GHz Band: the two Member States which have completed an award of spectrum in this band, the UK and Denmark, have done so on a national basis; 2.6 GHz Band: All other Member States have awarded national licences with the exception of Spain, where it awarded part of the spectrum on a regional /local basis.

⁶⁹ [ComReg Document 15/70](#), available at www.ComReg.ie

- (iii) considering (i) and (ii) above, in the 3.6 GHz Band there were benefits in terms of both spectrum efficiency and competition to proceed with a dynamic and scalable national and regional award.

- 5.6 In relation to bullet (i), ComReg noted that of the Proposed Bands, only the 2.1 GHz Band has existing deployments and these are licensed on a national basis.
- 5.7 In relation to bullet (ii), fixed wireless and mobile deployments are likely to be across the whole State and not limited to specific urban/rural areas.
- 5.8 In relation to bullet (iii), and in light of the above factors, ComReg noted that there do not appear to be any clear benefits in terms of spectrum efficiency or competition with the approach taken in the 3.6 GHz Award in the present case, and particularly given the additional complexity for ComReg and potentially for bidders such an approach would entail.

5.1.2 Views of respondents to Document 19/59R

Proposal for a limited number of individual rights of use

- 5.9 One respondent (Eir) supported the award of a limited number of rights of use.

Proposal for national licences

- 5.10 Four respondents submitted views in relation to ComReg's proposal for rights of use in each of the Proposed Bands to be for the entire State. Three respondents (Dense Air, Eir and Vodafone) agreed with this proposal, while one respondent (Imagine) disagreed.
- 5.11 The reasons provided by those that agreed can be summarised as follows:
- awarding national licences will promote consistent services for customers nationwide and prevent cherry picking of the most profitable areas (Vodafone);
 - it would be best to award national licences for the 2.3 GHz and 2.6 GHz bands to align with the need for 5G evolutions in rural and urban areas of Ireland (Dense Air); and
 - there is no rationale for regional licensing in respect of the Proposed Bands (Eir).
- 5.12 Imagine's main submissions and alternative proposals can be summarised as follows:

- i. The actions of other countries is largely irrelevant, in its view, and that considering the work of the ITU and identifying where these bands are identified for IMT is backward looking.
- ii. The primary concern for ComReg, in its view, should be to choose the option that will give rise to more competitive services being provided in underserved areas of Ireland.
- iii. ComReg's proposed approach favours mobile deployments, specifically:
 - a) It is not in keeping with the needs of the market or an efficient award process which encourages competition and service development; and
 - b) The approach will consolidate spectrum resources into the hands of MNOs, stifle service expansion, innovation and competition in the market.
- iv. Any new spectrum holder would need to build a network in well-served urban areas whether it wants to or not as it believes that the costs of the spectrum will likely be driven by population coverage as much as other factors.
- v. It disagrees that the approach in the 3.6 GHz Award is not relevant here and instead submits that there are many levels between local 20km and national licences that would bring real competition for spectrum and ensuring the correct levels of service available across the market.
- vi. It proposes that ComReg should consider awarding the regional and urban areas separately and, at the very least, must consider awarding spectrum in the urban CSO regions separately from the regional areas. However, it argues that it is not necessary to further split these rural areas into smaller regions as per the 3.6 GHz Award. It believes that this separation is essential for the integrity of the process overall and to properly take on board the needs of the market.
- vii. It disagrees that fixed and mobile services will likely be deployed across the whole State and submits that:
 - a) ComReg is aware of regional networks being deployed in the 3.6 GHz Band; and
 - b) with three MNO's and other fixed networks in urban areas there is little incentive for further competing network construction in urban areas.
- viii. it submits that ComReg, in other parts of the paper, identifies the spectrum as being suitable for mobile and fixed but then ignore it here.
- ix. It submits that the complexity of adding regional areas into the Proposed Award is not a material issue.

5.1.3 ComReg's assessment of respondents views

Proposal for a limited number of rights of use to the Proposed Bands

5.13 In Document 19/59R, ComReg proposed to award a limited number of rights of use to the Proposed Bands. ComReg notes that the one respondent which commented on this issue supported this proposal.

5.14 For the reasons set out in Document 19/59R and as summarised above, ComReg's preliminary decision is to award a limited number of rights of use to the Proposed Bands.

Proposal for national licences

5.15 By way of context, ComReg firstly sets out its key objectives in establishing the appropriate geographic extent of the rights of use in the Proposed Award and the factors informing ComReg's decision to design a scalable regional/national award for rights in the 3.6 GHz Band.

5.16 ComReg in its management of the radio frequency spectrum does so in accordance with its powers, functions, duties and objectives (as summarised in Annex 2). In relation to the current matter, the following are of particular relevance:

- ensure the efficient management and use of the radio frequency spectrum in Ireland;
- take the utmost account of the desirability of technological neutrality;
- promote competition⁷⁰; and
- contribute to the development of the internal market⁷¹.

5.17 By way of background ComReg sets out below the situation and relevant factors informing ComReg's approach to the 3.6 GHz Band Award.

The situation in the 3.6 GHz Band award was quite different

5.18 In advance of the 3.6 GHz Award, the existing rights of use awarded under the previous Fixed Wireless Access Local Area (FWALA) licensing framework were localised to 20km in radius. The overall geographic footprint⁷² of the large majority of the licensees under the FWALA licensing framework were thus

⁷⁰ Section 12 (1)(a)(i) of the 2002 Act.

⁷¹ Section 12 (1)(a)(ii) of the 2002 Act.

⁷² Where an operator obtained multiple 20km licences spread geographically.

local or regional, with Imagine holding the majority of the rights of use in the band at that time, which equated to a quasi-national footprint operating in both urban and rural areas.⁷³

- 5.19 All rights of use where due to expire and the design of the award facilitated existing rights holders to obtain rights of use for a further period to maintain and enhance the provision of existing services should they wish.
- 5.20 The information available to ComReg at the time, including the limited propagation characteristics of the 3.6 GHz Band and the submissions received from interested parties identified that there were potentially two main types of use for the band going forward;
- mobile deployment particularly in urban areas; and,
 - fixed wireless access deployment particularly in rural areas.
- 5.21 ComReg also noted that there may be a case that mobile deployments could be useful in urban centres in rural areas and that FWA deployment may also be suitable in urban areas. This view was informed by amongst other things, Imagine's submissions to the consultation process where it identified that FWA operations have a key role in urban areas so as to provide NGA connections to areas that do not have it⁷⁴, in addition facilitating choice and competition⁷⁵.
- 5.22 The information available and supported by the submissions received to the consultation process suggested that mobile deployments in more rural areas would be in the bands lower in frequency to the 3.6 GHz and that mobile deployments would likely be focussed on the cities.
- 5.23 Considering this, ComReg noted that if it was to offer national licences in the 3.6 GHz Band exclusively it might create the possibility of spectrum being less than optimally assigned.⁷⁶ For example if FWA was deployed in certain rural regional areas, the spectrum in the urban areas may not be used and conversely if mobile deployments were only initiated in urban areas, large swathes of the country would have little spectrum use. Consequently, it appeared that complementary uses best facilitated efficient use of the radio spectrum.

⁷³ When combining the various individual local licences awarded

⁷⁴ Where Imagine approximated it to be 10% of the market at the time, Imagine submission to Document 15/70 as published in Document 16/19

⁷⁵ Imagine in its submission to Document 14/101 identified that *“Even in urban areas where NGA wireline is available, FWA will provide much needed competition/choice for consumers, avo[i]ding the lack of competition that consumers face in the MBB market. Hence it is essential that FWA can access 3.6GHz via national licences, starting immediately.”*

⁷⁶ Paragraph 4.65 of Document 15/70

- 5.24 However, as noted by ComReg in Document 15/70, an outcome of establishing a regional award was that by establishing a boundary between two rights holders it would create an area where inter operator agreements would be required. In this regard, Plum in Document 15/73 advised ComReg that in the 3.6 GHz Band the area of interference could extend up to 60km from the boundary and even with employing mitigation techniques, the boundary between regions potentially creates an area where spectrum close it would be less than optimally used⁷⁷.
- 5.25 This possibility was balanced with ComReg's objectives against the other very clear benefits of a regional award, which included allowing existing local and regional rights holders obtain rights of use to continue to provide service to their customers using the same frequency band, helping to increase competition and while also allowing other uses of the band in other parts of the country increasing the efficiency of the spectrum use.
- 5.26 In contrast, the situation in the Proposed Bands is quite different.
- 5.27 Three of the Proposed Bands (700 MHz Duplex, 2.3 GHz Band and 2.6 GHz Band) are effectively greenfield spectrum, that will be clear⁷⁸ by the date that rights of use under the Proposed Award commence, and one band (the 2.1 GHz Band) is awarded on a national basis, hence allowing the existing licensees to compete for rights of use to maintain and enhance services in the band do not require regional licences.

Considering Imagine's concerns and proposals

- 5.28 ComReg must establish the appropriate geographic scope of the licenses considering its statutory objectives and duties, in particular those of promoting competition, ensuring the efficient use of spectrum, promoting the interests of users in the community and the development of the internal market.
- 5.29 **In relation to (i)** above, ComReg disagrees with Imagine's submission that the international context is irrelevant or backward looking. ComReg considers

⁷⁷ [REDACTED]

[REDACTED]

⁷⁸ With the exception of the dated 2.3 GHz Rurtel network, where Eir has indicated that it intends to decommission the service.

that the international context is useful information as an input to its proposals and to not do so would be inward looking.

5.30 Moreover, ComReg is obliged to consider international developments, in particular Article 12(5) of the 2002 Act states,

*“5) In carrying out its functions, **the Commission shall have regard to international developments with regard to electronic communications networks and electronic communications services**, associated facilities, postal services, the radio frequency spectrum and numbering”.*
(emphasis added)

5.31 Consideration of the allocation status of the bands as identified by the ITU is also of relevance. The ITU is at the forefront of promoting the harmonisation of radio spectrum use and identification of bands for specific services⁷⁹. This is targeted globally with the aim of identifying the largest possible markets. Ireland’s radio spectrum users, operating in a small country, will be well aware of the ensuing benefits of harmonisation, which include:

- the promotion of economies of scale;
- enhancing investment in R&D and product development;
- increasing competition in the supply of equipment, through multiple vendors competing in the provision of lower cost / better quality equipment, clear examples being mobile/fixed base stations and handset and consumer premises equipment; and,
- the reduction of risks of interference across international boundaries.

5.32 **In relation to (ii)** ComReg’s disagrees that its primary concern should be to facilitate underserved areas of Ireland, rather ComReg’s objectives includes a general objective of promoting the interests of all users within the community and this needs to be considered in any proposals. In this regard, a key policy objective entering this award has been to study and identify solutions to the connectivity challenges facing Ireland.

5.33 Notably ComReg commissioned a comprehensive suite of studies that aimed to understand the connectivity challenges facing Ireland. Frontier Economics in Document 18/103b, identifies amongst other things these connectivity challenges and the potential suite of solutions available as summarised in figure 3 of Document 18/103b, extracted below as Figure 1.

⁷⁹ See the recent outcomes of ITU WRC-19 in this regard, <https://www.itu.int/en/ITU-R/conferences/wrc/2019/Pages/default.aspx>

5.34 ComReg along with Government, industry and consumers has a role to play in meeting these challenges and ComReg's licence condition proposals as set out in Chapter 7 below contribute to this holistically.

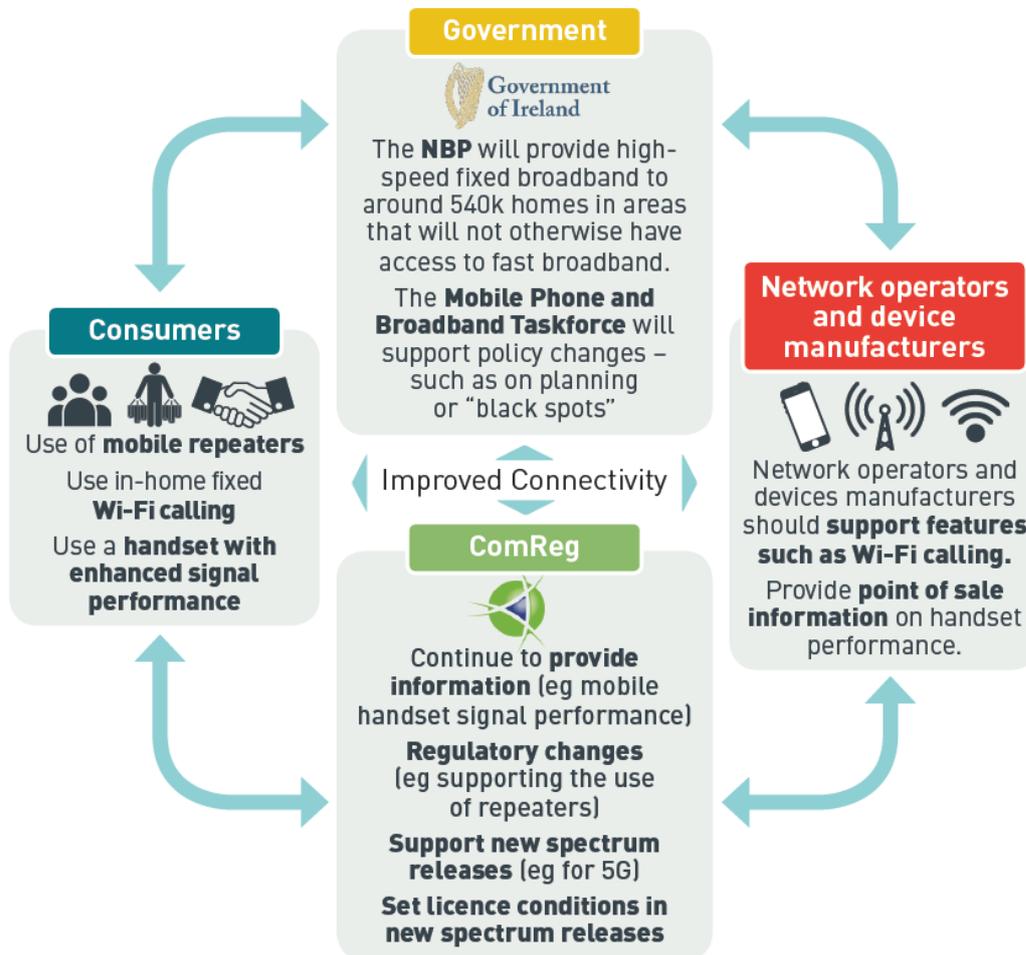


Figure 1: Stakeholder actions to improve connectivity (Figure 3 from Document 18/103b)

5.35 In relation to (iii), ComReg disagrees that it is favouring mobile. ComReg is proposing to award the frequency bands on a service and technology neutral basis, noting that for certain bands the likely uses could be mobile, fixed wireless or small cell use. The proposed award mechanism is an open competitive selection process, designed to determine the most optimum assignment of spectrum. Further the technical conditions applied to the rights of use issued on foot of the award process are technology neutral and the licence conditions take into account that there may be a variety of services deployed be they fixed wireless, mobile, or some other use. See for example, ComReg's proposed rollout obligations for the supra-1GHz bands where the obligation varies depending on whether a mobile or other services is provided. ComReg notes, as set out in detail below that the information available suggests that these services may well be deployed to a large extent, across the state.

5.36 Further and in relation to (iv), the obligations that ComReg proposes to attach to rights of use in the 700 MHz Band are aimed at providing coverage targeting 95% population and as such the services would be expected to provide coverage in the cities. However, the proposed rollout obligations for rights of use in the 2.1, 2.3 and 2.6 GHz bands are to rollout a certain number of base stations depending on the service being deployed. A key factor informing this is that there are different deployment scenarios for different services, should the network be mobile or other (including fixed wireless), and the freedom is given to the rights holder to deploy the base stations in locations where it meets its business plans once the minimum threshold is achieved nationally. There is no requirement to deploy base stations in the cities if the rights holder does not wish to do so.

5.37 In **relation to (v) and (vi)**, ComReg is aware of the many levels between local 20km licences and national licences but notes that the proposal by Imagine for regional areas reflects the rights of use it obtained in the 3.6 GHz Award. However ComReg observes a number of issues with this proposal:

- This would create a situation where, at a minimum, the spectrum around the border areas cannot be as efficiently used in either the affected parts of the 3.6 GHz⁸⁰ or Proposed Bands;
- Plum identified, in Document 15/73, that a coordination area in the 3.6 GHz Band would be in the order of 60km from the border of a region, as the Proposed Bands are between approximately 1 GHz (for the 2.6 GHz Band) and 2.8 GHz (for the 700 MHz Duplex) lower in frequency than the 3.6 GHz Band⁸¹ this coordination zone would increase and this would be informed by the propagation differences to the Proposed Bands. Indicatively, all other things being equal, the free space path loss differences suggest that this could be in the order of 83km and 290km for the 2.6 GHz Band and 700 MHz Duplex respectively⁸²;
- While these distances are coordination areas and implementation in these areas can be achieved by applying mitigation techniques, it still creates a situation where the spectrum at the boundary of these regions may be less than optimally assigned and used;
- This in turn may result in many consumers that cannot currently obtain a service in the 3.6 GHz Band being unable to do so in the future either.

⁸⁰ *ibid*

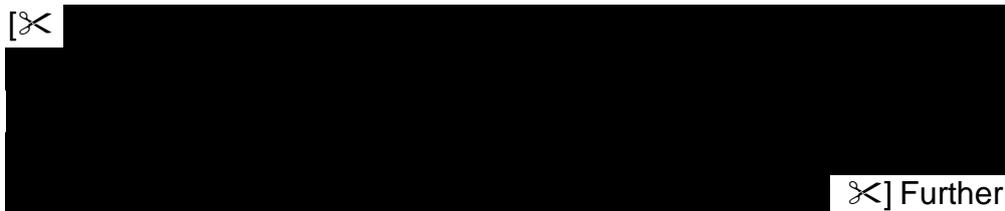
⁸¹ Comparing the centre frequencies of the 3.6 GHz, 2.6 GHz and 700 MHz bands.

⁸² [REDACTED]

This is exacerbated in the Proposed Bands as the size of these areas and the amount of customers affected would increase;

- Specifically, should the same or similar CSO boundaries be chosen as per the 3.6 GHz award and if the service was to be a fixed wireless broadband service, it would not be in the interests of promoting competition for this service in these extended areas⁸³;

- [X



X] Further, ComReg notes that customers on the more densely populated urban side of these boundaries may benefit from the provision of service.⁸⁵

5.38 In relation to **(vii) and (viii)**, based on the information available to it, ComReg is of the view that fixed wireless and mobile deployments in the Proposed Bands will likely be across the whole state, specifically;

- mobile deployments in the Proposed Bands would typically be across the whole state. The 700 MHz Band is planned for wide area coverage in both urban and rural areas, the 2.1 GHz Band has been deployed nationally, the 2.3 and 2.6 GHz Bands are likely to be used in areas where additional capacity is needed, for example urban centres including provincial towns.
- Dense Air, specialising in small cells, is supportive of national deployments in the Proposed Bands as it would align with the evolutions of 5G in both urban and rural areas.
- While noting that there are some local and regional⁸⁶ fixed wireless deployments in other bands with varying coverage footprints, Imagine the largest fixed wireless operator is currently operating quasi nationally using its rights of use in the 3.6 GHz Band as shown

⁸³ ComReg notes that while this will be case at the border with Northern Ireland, ComReg does not have discretion in relation to this. The use of the spectrum each side of the border is in accordance with the Memorandum of Understanding between ComReg and Ofcom (UK) as may be amended. <https://www.comreg.ie/industry/licensing/international-spectrum-coordination/> .

⁸⁴ ibid

⁸⁵ ibid

⁸⁶ Including, Lightnet - <https://www.lightnet.ie/rural-wifi-check-your-coverage/>,

Airspeed - <https://www.airspeed.ie/solutions/connectivity>

Ripplecom - <https://www.ripplecom.net/residential/coverage-checker/#>

Permanet <https://www.permanet.ie/broadband-coverage/>

in Figure 2 below⁸⁷. Further Imagine also holds some remaining 3.6 GHz transition licences that overlap or impact the city regions, where it contends that it still requires transition licences, including in the border areas to mitigate consumer disruption during the transition period.



Figure 2: Locations of Imagines' sites

5.39 ComReg notes that, depending on the business case and how it may evolve over the duration of the rights of use, that there may be certain geographic areas/or frequencies where a licensee, fixed wireless, mobile or small cell operator, may not provide a service. ComReg notes in this regard that leasing/trading of spectrum rights of use may be the most appropriate mechanism for addressing these cases. ComReg also notes that while regional and national licences were made available in the 3.6 GHz Band, the outcome of the award could have been achieved by either a consortium bid in advance of the award and/or by secondary trading⁸⁸ and that both these options would remain available in relation to the Proposed Award⁸⁹. ComReg notes that Imagine understands this as it is in accord with its submission to the 3.6 GHz Award⁹⁰

⁸⁷ As shown on its website on 16 December 2019

⁸⁸ For example, if the 3.6 GHz Award was conducted on a national basis, the specific outcome could have been achieved via a consortium bid between Airspan and Imagine and/or by secondary trading between operators of a limited number of lots in certain geographic areas.

⁸⁹ Spectrum Trading Leasing is as set out in Chapter 7, and the potential for consortia bidding will be detailed in ComReg's Forthcoming draft Information Memorandum.

⁹⁰ Imagine's submission to Document 15/70, published in Document 15/106R

where it suggested that “ComReg does not need to attempt to design an auction that can cater for every possible potential future use of the spectrum. Spectrum trading has been active in a number of EU Member States for some time now”.

- 5.40 In **relation to (ix)**, ComReg identified in Document 19/59R that there does not appear to be any clear benefits in terms of spectrum efficiency or competition with the approach taken in the 3.6 GHz Award in the present case, and particularly given the additional complexity for ComReg and potentially for bidders such an approach would entail. In light of the above, ComReg maintains this view.

ComReg’s Preliminary Decision

- 5.41 In light of the above, ComReg’s preliminary Decision is to make a limited number of individual rights of use available on a National basis for the Proposed Bands.

5.2 Band plans and compatibility considerations

5.2.1 Introduction

- 5.42 In Section 6.2 of Document 19/59R, ComReg set out its proposed band plans and compatibility considerations for each of the Proposed Bands. Block Edge Masks (BEMs) are implemented as technical conditions to ensure coexistence between neighbouring networks and for the protection of other services and applications in adjacent bands⁹¹.
- 5.43 This Chapter provides a summary of ComReg’s proposals for each of the four proposed bands in turn, as set out in Document 19/59R, and responses to Document 19/59R.
- 5.44 This Chapter also provides an update to information since the publication of Document 19/59R including Plum’s updated view on the 2.3 GHz and 2.6 GHz bands. An assessment of the available updated information, responses to consultation and updated consultant reports inform ComReg’s updated view are detailed below.

⁹¹ As a general point, in relation to guard bands ComReg set out its view in Document 19/59R that it does not propose to implement guard bands between assignments be that on a FDD or TDD or other mode basis.

5.2.2 The 700 MHz Duplex

Summary of ComReg's view in Document 19/59R

5.45 The 700 MHz EC Decision⁹² sets out frequency arrangements and a band plan for the 700 MHz Duplex Band, including:

- channelling arrangements of 2×30 MHz in the paired frequency range of 703-733 MHz and 758-788 MHz;
- block sizes of multiples of 5 MHz, where the lower frequency limit of an assigned block shall be aligned with, or spaced at, multiples of 5 MHz from the band edge of 703 MHz; and
- that the mode of operation shall be Frequency Division Duplex (FDD), the duplex spacing of which shall be 55 MHz with:
 - terminal station transmission (FDD uplink) located in the lower frequency band 703-733 MHz; and
 - base station transmission (FDD downlink) located in the upper frequency band 758-788 MHz.

5.46 Figure 3 below details 2×30 MHz of spectrum in the 700 MHz Band considered as part of the proposed award.

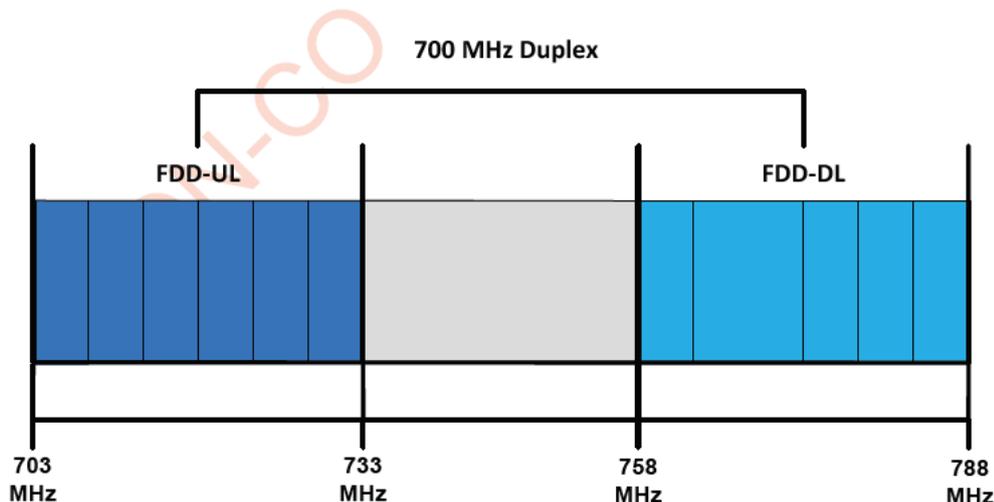


Figure 3: The 700 MHz Duplex Band Plan

Compatibility Considerations

5.47 The existing primary use of the 700 MHz band was Digital Terrestrial Television (DTT) operated by RTÉ. The Simulcast Period commenced on 4

⁹² General parameters Annex of EU Decision (EU) 2016/687

September 2019 and extends to 4 March 2020, which will mark the end of DTT operation in the 700 MHz band. As the 700 MHz rights of use will only be allowed to commence following full migration of DTT to below the 700 MHz band, ComReg anticipates no in-band compatibility issued between MFCN and DTT.

Out-of-Band Compatibility

- 5.48 ComReg noted in Document 19/59R that DTT services will continue to operate in the lower adjacent band (470-694 MHz) separating new services operating from 703 MHz by 9 MHz. Upper adjacent services will operate in 791 MHz – 821 MHz separated by 3 MHz from the highest frequency in the 700 MHz band (i.e. 698 MHz).
- 5.49 ComReg noted the work in CEPT in developing Least Restrictive Technical Conditions (LRTC) for the 700 MHz band, which are set out in the form of Block Edge Masks (BEM). These conditions ensure compatibility between deployments in the 700 MHz band and adjacent services.
- 5.50 The protection of the upper (MFCN) and lower adjacent services (DTT) is captured as part of the LRTC, specifically via the BEMs for the 700 MHz duplex band.

Deployment of MFCN with greater than 2x10 MHz in 700 MHz Duplex

- 5.51 In relation to the deployment of MFCN on a national basis with a bandwidth greater than 10 MHz (as outlined in CEPT Report 58), ComReg proposed the following in Document 19/59R:
- If a bidder won greater than 2x10 MHz but less than 2x30 MHz, then a constraint would be imposed on any spectrum assignments for that bidder that would exclude the lowest frequency block (i.e. starting at 703 MHz); and
 - If two bidders won greater than 2x10 MHz (i.e. each bidder won 2x15 MHz) in the “main stage”, then:
 - the assignment round would determine which bidder obtained the lowest frequency block; and
 - that bidder with the lowest frequency block would be prevented, by way of a licence condition, from deploying a channel bandwidth greater than 2x10 MHz starting at 703 MHz unless it could demonstrate that it could meet the unwanted emission power of -42 dBm/8MHz; and

- For completeness, if one bidder won all 2x30 MHz available, that bidder would be prevented, by way of licence condition, from deploying a channel bandwidth greater than 2x10 MHz starting at 703 MHz unless it can demonstrate that it can meet the unwanted emission power of -42 dBm/8MHz.
- 5.52 ComReg notes that if a bidder was to win more than 2x10 MHz of the available spectrum in the 700 MHz Duplex the winning bidder would be prevented, by way of licence condition, from deploying a channel bandwidth greater than 2x10 MHz starting at 703 MHz unless it can demonstrate that it can meet the unwanted emission power of -42 dBm/8MHz in the frequency range 470-694 MHz. This restriction is proposed in Annex 14 of this document (licence technical conditions).

Views of respondents to Document 19/59R

- 5.53 Two respondents (Three and Vodafone) agreed with ComReg's 700 MHz Duplex band plan proposals. No comments were received on the compatibility considerations in 19/59R relating to the 700 MHz Duplex.

ComReg's updated position

- 5.54 Having carefully considered all of the submissions received and noting that no respondents raised any particular issues with regards to the 700 MHz Duplex band plan proposals, ComReg proposes to implement band plan proposals for the 700 MHz Duplex as detailed in 19/59R and in line with the 700 MHz EC Decision.
- 5.55 In relation to compatibility issues between MFCN and DTT, ComReg notes that the migration of DTT out of the 700 MHz band is at an advanced stage and in line with the 700 MHz roadmap as published on DCCAE website⁹³. In this regard ComReg anticipates no in-band compatibility issues between MFCN and DTT at the time of the award of the 700 MHz Duplex.
- 5.56 In considering the deployment of MFCN on a national basis with a bandwidth greater than 10 MHz, ComReg intends to address this issue by way of a licence condition as detailed above. This licence condition is proposed in Annex 14 of this document.

5.2.3 The 2.1 GHz Band

Summary of ComReg's view in Document 19/59R

- 5.57 The 2.1 GHz EC Decision establishes the frequency arrangements for the 2.1

⁹³ [Ireland's National Roadmap on the Use of the 700MHz Frequency Band](http://www.DCCAE.ie), available at www.DCCAE.ie

GHz band in respect of which ComReg has no discretion. Specifically the 2.1 GHz EC Decision states:

*“The duplex mode of operation **shall** be Frequency Division Duplex (FDD). The duplex spacing **shall** be 190 MHz with terminal station transmission (FDD uplink) located in the lower part of the band starting at 1920 MHz and finishing at 1980 MHz and base station transmission (FDD downlink) located in the upper part of the band starting at 2110 MHz and finishing at 2170 MHz.”*
(emphasis added)

5.58 ComReg observed the work in CEPT and by the European Commission which intends to review the harmonised technical conditions for certain EU-harmonised frequency bands, including the 2.1 GHz Band, and to develop LRTCs suitable for next generation (5G) terrestrial wireless systems. ComReg also noted that it intends to establish the band plan and technical conditions in line with any amendments to the 2.1 GHz EC Decision when and if this occurs⁹⁴.

5.59 Figure 4 below details the 120 MHz of spectrum in the 2.1 GHz Band considered as part of the Proposed Award⁹⁵.

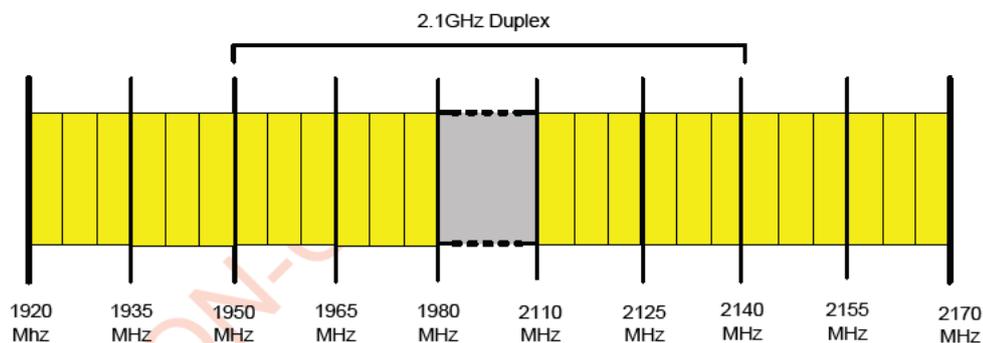


Figure 4: The 2.1 GHz Band Plan

Compatibility Considerations

5.60 As noted in Document 19/59R, the 2.1 GHz Band is currently licensed to Three, Vodafone and Eir and used exclusively for 3G UMTS, while the technical conditions facilitate in-band compatibility between the licensees.

⁹⁴ ComReg amended award licences in the 3.6 GHz band to provide for changes in the EC Decision relating to technical conditions of the licence.

⁹⁵ For reasons discussed in Chapter 3 the Unpaired 2.1 GHz Band (1900-1920 MHz) is not being considered for inclusion in the Proposed Award.

Out-of-Band Compatibility

5.61 The adjacent services to the 2.1 GHz Band are as follows:

- Lower adjacent services: one operator, Three, is licensed to operate in the frequency range 1,910-1,915 MHz (TDD). This right of use will expire on 01 October 2022. i.e. prior to the proposed commencement of new rights of use in the 2.1 GHz band; and
- Upper adjacent services: the frequency range 1,980-1,995 MHz and 2,170- 2,200 MHz is designated for use by the complementary ground component of mobile satellite services. There are two licences issued in the band, both of which expire on 13 May 2027. The mitigation measures required for coexistence of these services are detailed in ECC Reports 197 and 233 as well as the block edge mask defined in CEPT report 39.

5.62 In Document 19/59R, ComReg proposed not to implement a discretionary guard band of 300 kHz identified in the 2.1 GHz EC Decisions⁹⁶. ComReg is of the view that the BEM defined in the 2.1 GHz EC Decision, without the discretionary guard bands, should provide adequate protection against adjacent band interference.

Views of respondents to Document 19/59R

5.63 Two respondents (Three and Vodafone) agreed with ComReg's 2.1 GHz band plan proposals and no comments were received on the compatibility considerations in 19/59R relating to the 700 MHz Duplex. In relation to views on the technical conditions relating to 2.1 GHz band, these are detailed in Chapter 7 below.

ComReg's updated position

5.64 Having carefully considered all of the submissions received, ComReg notes that no respondents raised any particular issues with regards to the 2.1 GHz band plan proposals. In this regard ComReg considers the proposals as detailed in Document 19/59R to be acceptable and ComReg proposes to implement the plan proposals for the 2.1 GHz band as detailed in Document 19/59R and in line with the current 2.1 GHz EC Decision.

⁹⁶ See also footnote 91 relation to ComReg's general view on guard bands.

5.2.4 The 2.3 GHz Band

Summary of ComReg's view in Document 19/59R

5.65 In the absence of an EC decision for the 2.3 GHz Band, ComReg proposed in Document 19/59R to implement the Least Restrictive Technical Conditions (LRTC) outlined in the 2.3 GHz ECC Decision⁹⁷, while noting that should an EC Decision be adopted in the future, it would take into consideration the work within CEPT and, in particular, the LRTC detailed in the 2.3 GHz ECC Decision.

5.66 The 2.3 GHz ECC Decision includes the following frequency arrangements:

- a frequency range of 2,300 – 2,400 MHz;
- TDD mode of operation; and
- block sizes of multiples of 5 MHz (i.e. 20 × blocks of 5 MHz (100 MHz)).

5.67 Figure 5 below sets out 100 MHz of TDD spectrum in the 2.3 GHz Band considered as part of this proposed award.

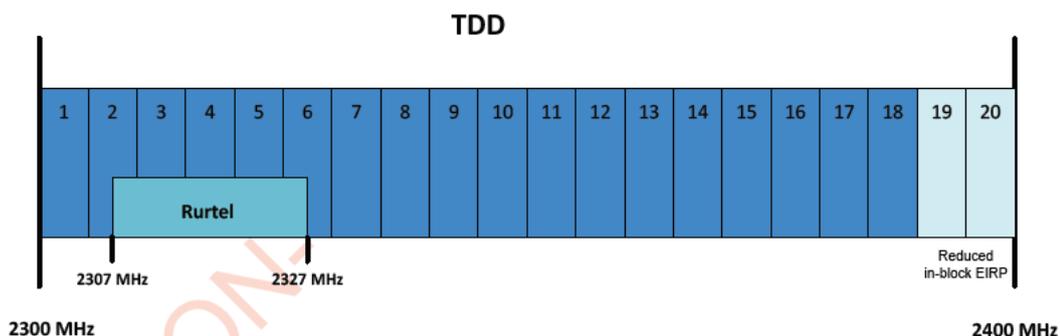


Figure 5: The 2.3 GHz Band Plan

5.68 The 2.3 GHz ECC Decision also sets out technical conditions for the spectrum blocks which are outlined further in Chapter 7 and Technical Annex 14 of this document.

Compatibility Considerations

5.69 In October 2018, ComReg commissioned Plum to conduct an analysis relating to the potential compatibility between future MFCN base stations and (a) existing RurTel network, and, (b) the adjacent channel WLAN networks.

⁹⁷ ComReg notes the implementation of this band plan as described in the 2.3 GHz ECC Decision has been adopted in other European countries, specifically in the UK and Denmark.

5.70 Plum's report, entitled "2.3 GHz Sharing Analysis" is published alongside Document 19/59R as Document 19/59d ("Plum 2.3 GHz Co-existence Report").

5.71 The following sections summarise ComReg's proposals in Document 19/59R for issues arising from (a) and (b) above.

(a) In-band compatibility issue with existing RurTel network

5.72 In the lower end of the 2.3 GHz Band, Eir holds a number of licences in the range 2307-2,327 MHz (paired with 2401-2421 MHz) for its RurTel Network (blocks 2 to 6 in Figure 5 above (2305-2330 MHz)) which is a point-to-multipoint system used to provide fixed telephony services (voice-only) in areas of counties Galway, Kerry and Donegal as part of Eir's Universal Service Obligation ("USO").

5.73 The total number of active RurTel customers reported at time of publication of Document 19/59R was 87, being comprised of:

- 2 active customers in the area of Kerry, who were supported by 6 licences. ComReg understands that this consisted of 8 repeater stations and 2 customer stations;
- 8 active customers in the area of Galway, who were supported by 7 licences. ComReg understand that this consisted of 5 repeater stations and 6 customer stations with; and
- 77 active customers in the area of Donegal who were supported by 21 licences. ComReg understands that this is a more complex network and consisted of a number of repeater stations and customer stations.

5.74 Based on Plum's findings as outlined in Document 19/59d, ComReg noted that the large coordination areas for the deployment of MFCN (covering all the composite interference levels described in Document 19/59d) would have a significant impact on the potential rollout of any future MFCN services in this band. In this regard, ComReg proposed in Document 19/59R to implement "coordination areas" derived from the calculated composite interference contours, for the areas of Galway, Kerry and Donegal until such time that Eir fully migrates its RurTel network from the 2.3 GHz band. In these coordination areas, any MFCN deployment would require coordination with Eir to ensure coexistence with its RurTel network, noting that these areas would reduce in the event of full migration of any individual area (as opposed to a single link).

5.75 In the case of adjacent channel coexistence between adjacent MFCN blocks and RurTel, Based on Plum's findings, ComReg does not envisage any adjacent block compatibility issues between MFCN and RurTel.

(b) The adjacent channel WLAN networks (out-of-band compatibility issue)

- 5.76 The two uppermost 5 MHz blocks in the band (2390-2400 MHz) are adjacent to WLAN's operating above 2400 MHz (blocks 19 and 20 in Figure 5 below).
- 5.77 ComReg noted that the 2.3 GHz ECC Decision defines a BEM for applications in the 2.3 GHz band and provides that the reduced in-block EIRP limit applicable between 2390 – 2400 MHz and the additional baseline BEM out-of-band EIRP limits applicable above 2,403 MHz would be sufficient to enable adjacent band coexistence between MFCN and WLANs.
- 5.78 Plum in its report for ComReg (Document 19/59d), concluded that *"in implementing the specific limits outlined in the ECC Decision (14)02 for the protection of WLAN devices, adjacent band coexistence between MFCN and WLANs is feasible without additional implementation measures from ComReg"*.
- 5.79 In light of the above, and noting that other Member States who have, or who intend to award this band have included the measures identified in the 2.3 GHz ECC Decision (e.g. Denmark, Sweden), ComReg is of the view that no requirements beyond the introduction of restricted blocks between 2390 – 2400 MHz are needed to enable effective adjacent band sharing between MFCN and WLANs.

Views of respondents to Document 19/59R

- 5.80 Two respondents (Three and Vodafone) agreed with ComReg's 2.3 GHz band plan proposals.
- 5.81 In relation to compatibility considerations of the 2.3 GHz Band, three respondents (Three, Vodafone and Imagine) submitted that significant uncertainty and excessive restrictions prevail in the 2.3 GHz band due to the presence of RurTel.
- 5.82 In this respect, Three submitted that:
- the channels occupied by RurTel do not align with ComReg's 2.3 GHz band plan and leaves 25 MHz impaired.
 - Eir should be required to reduce the RurTel bandwidth as the current 20 MHz is not justified.
 - The exclusion / coordination zones suggested by Plum are surprisingly large, in its view.

- It should be possible to set a termination date for RurTel (for example the end of 2021) in its view and also notes that Eir claims 99% geographic coverage with its mobile coverage.

5.83 In its response Vodafone submitted that:

- Very significant restrictions exist in the 2.3 GHz band due to RurTel that do not in its view fairly balance the benefit of the served customers with the general population.
- Plum's technical coordination appears excessively cautious, including the required exclusion zone (which itself is probably excessive), is clearly inefficient in its view and suggests that ComReg use its powers to insist that Eir finds an alternative solution for RurTel customers in a specified time period.

5.84 Imagine submitted that:

- The approach to 2.3 GHz (RurTel) is in its view significantly disproportionate and spectrally inefficient.
- A revised approach to the migration of RurTel out of the 2.3 GHz band should be sought in its view including the provision of a hard deadline for Eir to provide alternative service to its 87 customers.

Updated Information relating to the 2.3 GHz Band

Eir RurTel Network Update

5.85 On 27 September 2019 ComReg issued a request for information to Eir regarding Eir's licences in the 2.3 GHz Band used for its RurTel Network. In its letter ComReg sought information from Eir regarding:

- (i) Number of active customers on the RurTel Network;
- (ii) Migration activities and locations of remaining RurTel customers; and
- (iii) Technical parameters.

5.86 With respect to (i), in its response dated 31 October 2019, Eir provided confirmation of the decommissioning of RurTel services in the Kerry area, stating that:

"eir has now fully decommissioned the RurTel system in Kerry, there are no active customers, all base station sites are been deactivated and RurTel licences have been cancelled."

5.87 In relation to the Galway area, Eir confirmed that there are 4 active customers,

or a reduction of 50% since the publication of Document 19/59R.

5.88 In relation to Donegal, Eir stated that:

“eir has 76 active customers on the Donegal RurTel system, each customer location has been surveyed and eir continue to assess opportunities to provide alternate voice solutions for these customers particularly as mobile voice service is enhanced in these areas.”

5.89 The total number of active RurTel customers is now 80, being comprised of:

- 4 active customers in the area of Galway, who are supported by 6 licences. ComReg understand that this consists of 6 repeater stations and 4 customer stations.
- 76 Active customers in the area of Donegal who are supported by 21 licences. ComReg understands that this is a more complex network consisting of a number of repeater stations and customer stations.

5.90 Regarding (ii), Eir, in its response dated 31 October, provided ComReg with location details of its remaining customers on its Galway and Donegal RurTel network. Eir did not provide any detail on its plans to migrate these remaining RurTel customers out of the 2.3 GHz band. However, Eir states that it:

“continues to assess opportunities to provide alternate voice solutions for these customers particularly as mobile voice service is enhanced in these areas”

5.91 On 5 December 2019, Eir provided additional comments which included survey details in relation to availability of alternative services (Fixed Cellular Service) to these customers based on current network deployments, which indicate that two of the customers in the Galway area and the majority of the customers in Donegal could be migrated with relative ease.

5.92 In relation to (iii), Eir, in its response dated 5 December 2019 provided comment in relation to Plum’s report (Document 19/59d) and contended that there are a number of inaccuracies with regards to the report’s technical details. However as Eir did not provide any update with regards to this information, Plum noted that there is no basis to amend its current assumptions.

Updated Plum Reports

5.93 Document 19/59d provides Plum’s report analysing the potential compatibility and co-existence measures necessary to facilitate the co-existence of future WBB networks in the 2.3 GHz band with Eir’s RurTel network. Plum has

revised its analysis of the RurTel network taking into account changes indicated by Eir in its response of 31 October 2019 and consideration of its response of 5 December 2019.

- 5.94 The updated Plum report, published alongside this document as Document 19/124c, details the further work undertaken by Plum since the publication of Document 19/59d (including further work and measurement studies relating to the 2.6 GHz band and Document 19/59c).
- 5.95 In its updated report Plum takes into account the decommissioning of Eir's RurTel network in Kerry and a reduction of 2 licences in Galway. Plum notes in its updated analysis that:

“The reduction of RurTel sites means that the area where coordination is necessary in Kerry is no longer applicable but the removal of the two redundant sites in Galway has no impact on the overall coordination area.”

- 5.96 Figure 6 below illustrates the revised composite interference contours relevant to Eir's RurTel network⁹⁸ for Galway and Donegal:

⁹⁸ Markers for the individual RurTel base stations have also been included to provide clarity on the location of the RurTel network.

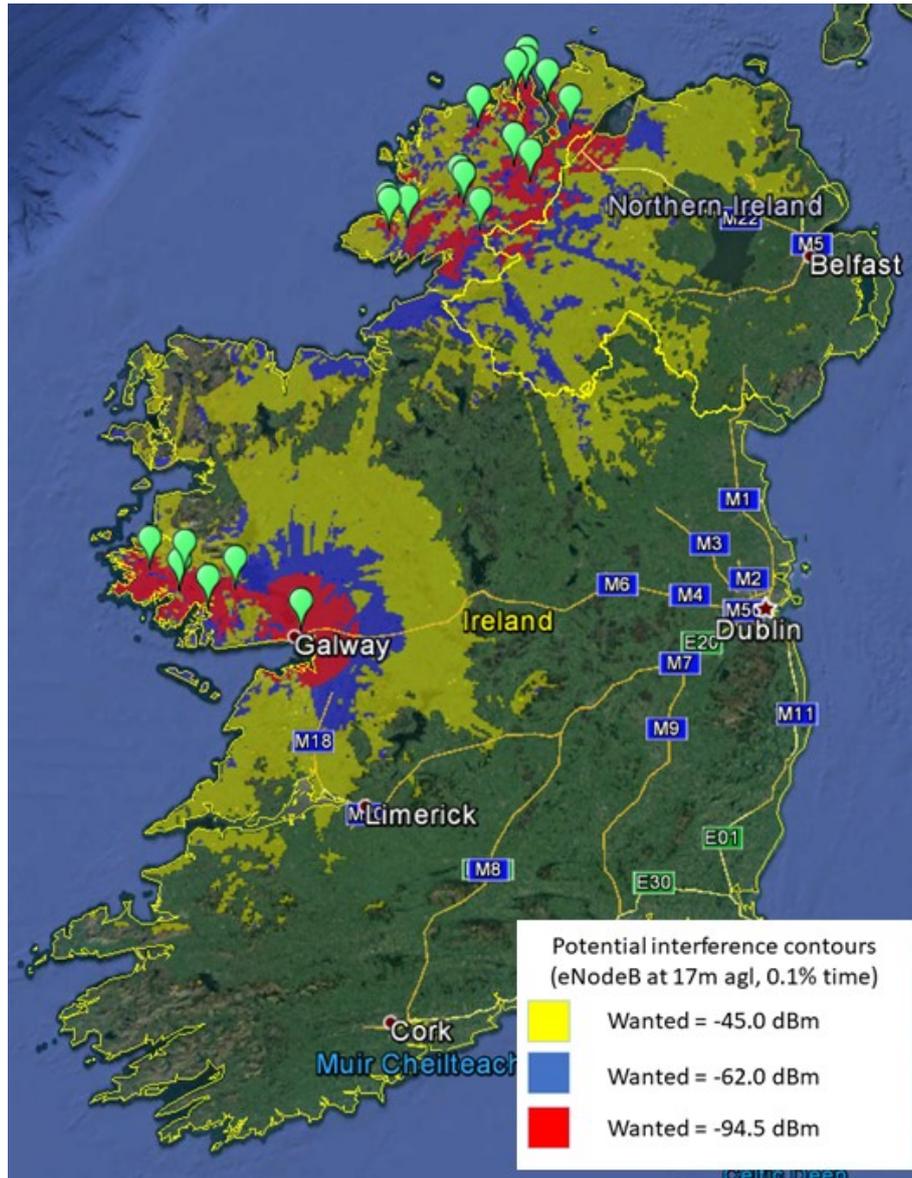


Figure 6: Composite Interference Contours Calculated for RurTel BS Receivers (0.1% of time) source: Document 19/124c

5.97 Plum states in its updated report that the conclusions and recommendations provided in Document 19/59d still apply, as summarised below:

- for MFCNs to be deployed in areas surrounding RurTel base station receivers⁹⁹, a coordination procedure should be defined to ensure co-existence between proposed MFCN deployments and existing RurTel networks;

⁹⁹ The size of coordination areas varies with the assumed interference threshold as shown Figure 6 above

- In the event that the RurTel network is further reduced or retired from the 2.3 GHz band, the requirement for a coordination procedure should be assessed to reflect any changes; and
- In the case of adjacent channel co-existence, the results show that adjacent channel coexistence between MFCN and RurTel is likely to be feasible in practice without any coordination requirements for most deployment scenarios¹⁰⁰.

5.98 In considering Eir's comments in its response of 5 December 2019, Plum notes that:

"these would not impact the output of the modelling completed to date, in particular as no revised equipment parameters were available and this was one key area of uncertainty."

5.99 Plum concludes that based on Eir's response there is no basis for further amending its analysis.

ComReg's assessment of respondent's views

5.100 ComReg observe that three respondents (Vodafone, Three and Imagine) provided comment relating to the 2.3 GHz band plan as set out in Document 19/59R. These respondents views are considered below under:

- (i) Spectrum efficiency;
- (ii) A RurTel Termination date; and
- (iii) Coordination Areas.

(i) **Spectrum Efficiency**

5.101 Since the publication of Document 19/59R, ComReg has been engaging with Eir to better understand the nature and scope of the RurTel network, including obtaining clarity regarding Eir's current activities and overall plans to migrate the RurTel customers to alternative platform/s.

5.102 In that regard, ComReg refers to the correspondence between it and Eir dated 31 October 2019 and 5 December 2019 in which it confirmed the decommissioning of Kerry and reduction in active customers in Galway, as discussed above.

¹⁰⁰ Plum state that, "while noting uncertainty exists regarding the RurTel receiver performance (e.g. receiver selectivity) and link budgets, it is our view that adjacent channel coexistence between MFCN and RurTel networks could be feasible without the implementation of coordination areas for most deployment scenarios."

5.103 Moreover, Eir has provided survey details in relation to the availability of alternative services (Fixed Cellular Service) to these customers based on current network deployments, which indicates that two of the customers in the Galway area and the majority of the customers in Donegal could be migrated with relative ease.

5.104 With regards to reducing the bandwidth currently occupied by Eir, Plum has based its analysis of the RurTel network on the technical information available and provided by Eir. Due to the complexity and nature of the network and particularly the age of the RurTel equipment, it may not be possible to reduce the overall bandwidth of the RurTel system, however ComReg understands that Eir is continuing to assess suitability of alternative services to replace the current RurTel network.

5.105 ComReg continues to engage with Eir and is hopeful that Eir will proactively implement alternative solutions for its RurTel customers in a timely fashion so as to not unduly impact upon the design and/or implementation of the Proposed Award, and the efficient use of spectrum (and benefits to all consumers from same) going forward.

(ii) RurTel termination date

5.106 Three respondents (Imagine, Vodafone and Three) noted that, in their view, ComReg should, using its statutory powers, implement a termination date by which Eir would migrate the RurTel network from the 2.3 GHz band.

5.107 In relation to a setting a termination date, there are a number of factors to consider which ComReg outlined previously in Document 19/59R, in particular that:

- The RurTel network provides voice services to customers in rural areas of the State currently do not have access to an alternative fixed telephony service;
- That the prolonged continuation of the existing situation is unlikely to constitute the efficient use of the relevant spectrum, given amongst other things:
 - the considerable quantum of spectrum currently occupied by this network together with the very small number of customers of the network;
 - the alternative uses for this spectrum (e.g. wireless broadband) and the substantial number of consumers in the identified co-ordination areas who would otherwise benefit from such alternative uses using this spectrum;

- that there are a number of technologies that are capable of delivering enhanced services to existing RurTel customers, including FWA with VoIP technology, mobile-based services (with a fixed repeater/ fixed cellular solution if required), and point-to-point links (in other bands);
 - that Eir has a range of alternative spectrum holdings with which to deploy such technologies so as to provide such enhanced services to existing RurTel customers (and other customers in these areas); and
 - ComReg acknowledges that the rollout of NBP could have a significant impact on the availability of new alternatives services in rural areas; and
- ComReg recognises that the extent and timing of Eir's migration activities going forward will have a bearing on the Proposed Award (and the longer term efficient use of the relevant spectrum).

5.108 In ComReg's view, when the above matters are taken together, particularly in the context of ComReg's objective to promote the interests of users including by ensuring that all users have access to a universal service and its other relevant statutory obligations including to promote competition, it would therefore be appropriate to consider transition arrangements for the migration of RurTel. In this regard ComReg notes the four transition principles which applied in the 3.6 GHz transition:

- minimise the potential for disruption to existing consumer services;
- introduce new rights of use in the 2.3 GHz Band as soon as possible, not unnecessarily delaying the delivery of future liberalised services;
- maximise benefits to end-users; and
- ensuring the efficient use of spectrum

5.109 ComReg detailed its RurTel transition plan in Chapter 9 of Document 19/59R which includes:

- continuing to license the RurTel network under the existing licensing framework but only up until the commencement date of new rights of use in the 2.3 GHz Band. That is, where ComReg would not renew or extend Eir's existing rights in the band beyond this date; and
- implementing a transitional licensing framework for the RurTel network whereby, following the Proposed Award and depending on the outcome of same, Eir would be provided the option, upon proper application (including payment of appropriate fees – see further below), to obtain sufficient transitional rights of use in the 2.3 GHz Band with

which to maintain the RurTel services for a limited period of time and subject to various conditions.

5.110 The transitional framework as proposed by ComReg in Document 19/59R is discussed further in Chapter 8 below.

(iii) Coordination Areas

5.111 Two respondents to 19/59R (Vodafone and Three) stated that, in their view the coordination areas suggested by Plum are excessively large.

5.112 ComReg notes Plums assessment in its updated report (Document 19/124c) that takes into account correspondence from Eir to date and states:

“The RurTel sharing analysis is based on the available parameters for the RurTel system at time of publication. In practice it may be possible to minimise co-ordination zones but currently there is no basis for amending the outcome of the Plum analysis considering the technical information provided to ComReg by Eir.”

ComReg’s updated position

5.113 In relation to RurTel, ComReg observes two relevant updates to the 2.3 GHz Band since the publication of Document 19/59R:

- the information received from Eir dated 31st October 2019 and 5 December 2019; and
- Plum’s updated analysis of the RurTel network (Document 19/124c).

5.114 Considering Document 19/124c (Plum’s updated report), and ComReg’s coordination area proposal above, Plum provided a revised composite interference plot which provides the recommended coordination areas between RurTel and MFCN deployments.

5.115 Despite the progress on the decommissioning of RurTel sites, given the number of users in Donegal and small number in Galway, ComReg is of the view that full migration is unlikely to occur prior to the Proposed Award. In that regard, ComReg is of the overall view that in the case of the 2.3 GHz band:

- Coordination areas for Galway and Donegal would be required to ensure coexistence between MFCN deployment and the RurTel network; and
- It will continue to engage with Eir on progressing the decommissioning of RurTel and in that respect consider each of the three transition scenarios as set out in Chapter 8 below.

5.116 Having carefully considered all of the submissions received and the revised Plum Report and having regard to its statutory functions, objectives and duties ComReg proposes to:

- Implement the 2.3 GHz TDD band plan as set out in the 2.3 GHz ECC Decision;
- ensure compatibility with:
 - existing RurTel services by implementing coordination areas as detailed in Plum's updated report on the 2.3 GHz (Document 124/c); and
 - with adjacent WLAN services in the 2.4 GHz band by implementing restrictions as outlined in ECC Decision and captured in Annex 14 below;
- facilitate Eir's RurTel licences up until the commencement of new rights of use in the 2.3 GHz band for MFCN. Following the award of spectrum in the 2.3 GHz band, ComReg proposes to issue Eir with a transitional licence (addressed further in Chapter 8) to facilitate migration of customers from the current RurTel service to alternative services.

5.2.5 The 2.6 GHz Band

Summary of ComReg's view in Document 19/59R

5.117 The 2.6 GHz EC Decision sets out a band plan consisting of 190 MHz of spectrum in the frequency range of 2500 MHz to 2690 MHz.

5.118 The band plan set out in the 2.6 GHz EC Decision is illustrated in Figure 7 below (the "2.6 GHz Primary Band Plan") and comprises:

- 2x70 MHz paired arrangement in the frequency ranges of 2500-2570 MHz and 2620-2690 MHz ("2.6 GHz FDD Duplex"); and
- 50 MHz unpaired arrangement in the frequency range 2570-2620 MHz ("2.6 GHz Duplex Gap") – which can be used for TDD or other modes compatible with the technical conditions of the 2.6 GHz EC Decision.

5.119 In the 2.6 GHz Primary Band Plan restricted blocks would be required where FDD and TDD spectrum blocks are adjacent to one another. The 2.6 GHz EC Decision sets out the in-block levels and BEM for the restricted blocks in the ranges 2570 – 2575 MHz and 2615 – 2620 MHz. This is detailed further in Chapter 7 and Technical Annex 14 of this document.

5.120 Figure 7 below describes the primary 2.6 GHz band plan consisting of 2x70

MHz FDD spectrum and 50 MHz TDD spectrum considered as part of this proposed award.

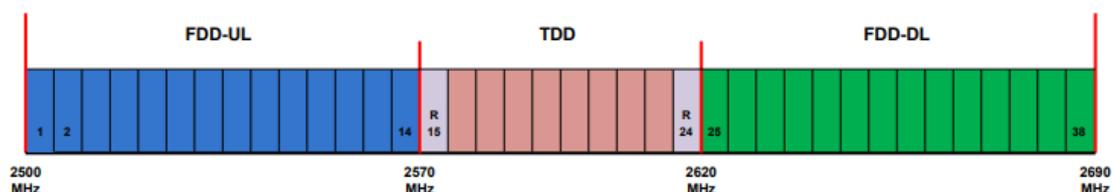


Figure 7: Proposed 2.6 GHz Band Plan

5.121 The 2.6 GHz EC Decision alternatively allows the use of the 2.6 GHz FDD Duplex sub-bands (i.e. 2500–2570 MHz and 2620 – 2690 MHz), in part or in full, for TDD. Any such use (which is to be decided at a national level) is required to be in equal parts in both the upper part of the band starting at 2690 MHz (extending downwards) and the lower part of the band starting at 2570 MHz (extending downwards).

5.122 In relation to this national discretion, ComReg observed a number of factors in Document 19/59R which indicate that the 2.6 GHz Primary Band Plan would be more appropriate, including that:

- the majority of Member States have adopted the 2.6 GHz Primary Band Plan;
- DotEcon advises against the alternative band plan as such an approach would add complexities to the spectrum award and spectrum assignment; and
- ComReg noted the following additional matters:
 - the device ecosystem utilising the 2.6 GHz Primary Band Plan is greater than for the alternative band plan;
 - ComReg is proposing to also make the 2.3 GHz Band available (comprising 100 MHz of TDD rights), which has a stronger device ecosystem and may be more attractive to potential users than the alternative band plan;
 - absent assigning the entire band for TDD, the alternative band plan may be less spectrally efficient because of the need to introduce additional restricted blocks to ensure compatibility between TDD and FDD blocks, limiting the extent of deployments in those blocks;
 - as the 2.6 GHz Primary Band Plan has been adopted in the UK, the adoption of the alternative band plan in Ireland would create frequency coordination issues in deploying services along the

border to account for interference between FDD and TDD networks;

- although ComReg did not discuss this issue in Document 18/60, some respondents (Dense Air, Three and Vodafone) stated that the primary band plan should be used; and
- The European Communications Office identifies that national TDD flexibility has not been implemented in CEPT countries¹⁰¹ and recommends that the introduction of MFCN in this band be based on the 2.6 GHz Primary Band Plan.
- the draft CEPT Report 72¹⁰² recommends that this band be based on the 2.6 GHz Primary Band Plan.

5.123 In light of the above, ComReg's preliminary view in Document 19/59R was that the 2.6 GHz Primary Band Plan should be adopted, subject to any amendments to the 2.6 GHz EC Decision on foot of the CEPT mandate previously discussed.

5.124 In Document 19/59R ComReg also observed that work is progressing in EC and CEPT to review the harmonised technical conditions for certain EU-harmonised frequency bands, including the 2.6 GHz Band, and to develop LRTCs suitable for next generation (5G) terrestrial wireless systems. ComReg intends to establish the 2.6 GHz band plan in line with the current 2.6 GHz EC Decision and implement any subsequent amendments that may be published after the award.

Compatibility Considerations

5.125 As the previous use of the 2.6 GHz Band (for Multichannel Multipoint Distribution Services (MMDS)) ceased in April 2016, no in-band coexistence issues arise.

Out-of-Band Compatibility

5.126 In October 2018, ComReg commissioned Plum to examine the compatibility and coexistence of incumbent aeronautical radar services in the 2700 MHz to 2900 MHz band ("2.7 GHz Band") with MFCN base stations operating in the 2.6 GHz Band. This considered both the international and national context. Plum's 2.6 GHz Report was published alongside Document 19/59R as

¹⁰¹ ECO Report 03 on the licensing of mobile bands in Europe presents the most recent information available to the European Communications Office (ECO) on the licensing of the mobile frequency bands in CEPT countries, available at <https://www.efis.dk/views2/report03.jsp>

¹⁰² [Draft CEPT report 72](#) on Report A in response to EC Decision, available at www.cept.org is under public consultation until 26 April 2019 and is due for completion by 02 March 2020.

Document 19/59c.

- 5.127 In Ireland, there are currently four primary aeronautical radars operating in the 2.7 GHz band located in Shannon, Cork and two in Dublin. From our discussions with the IAA¹⁰³, it is understood that one of the two radars located in Dublin uses an older model Thales TA 10M TD radar. At the time of publication of Document 19/59R, ComReg understood that this radar was currently being decommissioned and replaced with a Thales Star 2000 radar which includes the appropriate filtering to mitigate issues identified in this report. Therefore, the 2.6 GHz Report considered only the remaining three radars, the Thales Star 2000, used in Shannon, Cork and Dublin and assumed that the Thales TA 10M TD radar would not be in operation at the time of ComReg's spectrum award.
- 5.128 ComReg outlined that it would seek an update in relation to the progress made on decommissioning this radar and relevant timelines concerning establishing new radar.
- 5.129 In light of the approaches taken in the benchmark countries and the analysis and recommendations from Plum, ComReg proposes to implement mitigation measures recommended by Plum in Document 19/59c and updated in Document 19/124c to ensure coexistence between aeronautical radars operating in the 2.7 GHz band and new MFCN base stations in the 2.6 GHz band.
- 5.130 To ensure coexistence from blocking, intermodulation and spurious emissions, for operators in the 2.6 GHz band, ComReg proposed to implement the following:
- for blocking and intermodulation mechanisms:
 - the installation of filters at the aeronautical radar to protect against blocking and intermodulation caused by MFCN base stations based on conclusions of Plum Report 19/59c; and
 - for spurious emissions:
 - imposing a pfd limit on out-of-band emissions of -145 dBW/m²/MHz on MFCN base stations per operator at the radar antenna to address the impact of MFCN spurious emissions;
 - that if, MFCNs are deployed before filters are installed at the aeronautical radar, an additional out of band pfd limit of -83 dBW/m² be imposed to address the impact of blocking and

¹⁰³ ComReg and Plum met with the IAA on 25 September 2018 in the IAA offices in Shannon.

intermodulation effects at radar receivers during the transition period (to be defined); and

- o a coordination zone of 1 km around the aeronautical radar to provide additional protection from MFCN base stations; and

5.131 Observing that the first mitigation measure (i.e. installation of filters at the aeronautical radar) would be particularly effective in addressing coexistence issues, ComReg would continue to actively engage with the IAA and other relevant stakeholders with a view to implementing this mitigation measure in a manner that minimises the duration of which an additional out-of-band pfd limit of -83 dBW/m² would need to be imposed.

Views of Respondents to Document 19/59R

5.132 Two respondents (Three and Vodafone) agreed with ComReg's 2.6 GHz band plan proposals. One respondent (Imagine) disagreed with ComReg's band plan proposal contending that, in its view, it is more efficient for this spectrum to be fully assigned on a TDD basis.

Updated information: 2.6 GHz compatibility with radars

5.133 In October 2019, Plum completed its measurement report on the impact of MFCN deployment in the 2.6 GHz band on Radar services in the adjacent 2.7 GHz band. Plum's Measurement report entitled, "Shannon IAA radar - interference susceptibility measurements" is published as Document 19/124d.

5.134 In its report Plum states that:

"the testing confirmed that interference thresholds for two of the three interference mechanisms (intermodulation and spurious emissions) were comparable with those measured on the same model radar in Belgium in 2011, and since used for interference modelling by ComReg. Although an accurate value could not be obtained for the blocking mechanism¹⁰⁴, the interference susceptibility of the radar is determined by the other two values, as these occur at significantly lower interference power levels."

5.135 ComReg notes that the measurements conducted in Shannon Airport broadly confirm the assumptions made in 19/59c and reaffirm recommendations provided in Document 19/59c.

5.136 These recommendations are summarised below:

¹⁰⁴ The 'blocking' mechanism causes a degradation in the gain of the radar receiver. This degradation will be visible only as a lack of sensitivity, or a reduction in the probability of detection. During the testing no targets presented themselves on the appropriate azimuth to prove the presence of the blocking interference mechanism.

- That radar filters should be installed on the Star 2000 Radar sites in Ireland, at Shannon, Cork and Dublin to address interference due to blocking and intermodulation, in line with mitigation techniques of the benchmark countries of UK, Belgium and France;
- to address the impact of MFCN spurious emissions, a pfd limit of -145 dBW/m²/MHz at the radar receiver antenna location should be satisfied by each operator;
- that if MFCNs are deployed before radar filters are fitted, then an additional in-band radiation limit is required in the frequency range of 2,570-2,690 MHz to address the impact of blocking and intermodulation effects at radar receivers in the adjacent band. This restriction as derived in Document 19/59c is a pfd limit of -83 dBW/m² at the radar receiver; and
- to ensure protection of radars from MFCN base stations where they are operating in close proximity, that a 1 km coordination zone should be applied around the radars in Dublin, Shannon and Cork assuming that radar receivers are fitted with filters, where:
 - Inside the 1 km coordination zone, MFCN operators would be required to coordinate with the radar operator, regardless of antenna gain value or compliance with pfd limit; and
 - Outside the 1 km coordination zone, each potential MFCN operator would be required to comply with the defined pfd limit (-145 dBW/m²/MHz).

TA-10M TD Radar at Dublin

5.137 In Document 19/59c, ComReg noted that one of the two radars located in Dublin uses an older model Thales TA-10M TD (“TA10”) radar. This old radar was planned to be decommissioned and replaced with a radar which includes the appropriate filtering to mitigate issues identified in Document 19/59c. However, since the publication of Document 19/59c, in discussions with the IAA, it was indicated that the decommissioning of the TA10 Radar has been delayed.

5.138 ComReg understands that due to this delay there is the possibility that the TA10 radar may remain in operation in addition to the Star 2000 radars when the award commences. In light of this, ComReg requested Plum to develop an interference area predictions for the existing TA10 radar at Dublin airport to provide an indication of its impact on the 2.6 GHz band prior to its decommissioning.

5.139 Plum in Document 19/124c indicates (see Figure 8 below) that the TA10 radar could significantly impact on deployment of MFCN in Dublin and surrounding

areas and has a potential interference range of approximately 100 km from the radar location.

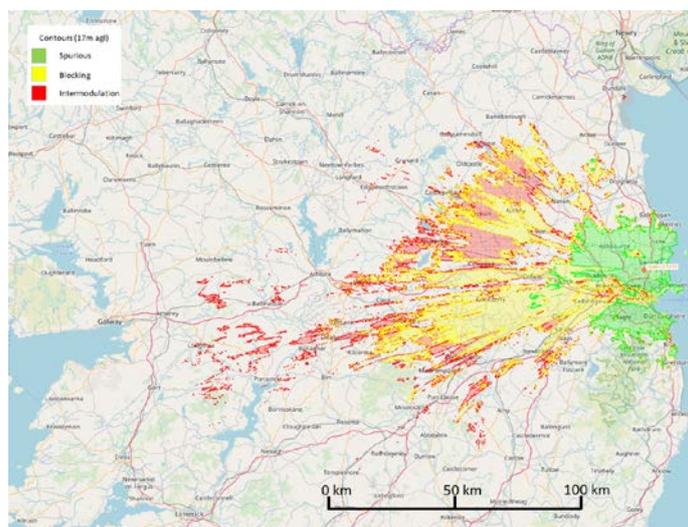


Figure 8: Interference contours for Dublin TA-10M TD airport radar

5.140 Similar to the Star2000 radar, Plum recommends in Document 19/124c the following restrictions on the TA10 radar should it be in operation at the time of the Proposed Award:

- **Blocking and intermodulation:** To address the impact of blocking and intermodulation effects at radar receivers in the adjacent band the restriction derived in this report, based on the Belgian study, for the Irish context is in the form of a pfd limit of -93 dBW/m^2 at the radar receiver; and
- **Spurious Emissions:** The report concludes that a pfd limit of $-156 \text{ dBW/m}^2/\text{MHz}$ at the radar receiver antenna location should be imposed to address the impact of MFCN spurious emissions.

ComReg's assessment of respondent's views

5.141 In relation to Imagine's comments regarding the use of the 2.6 GHz secondary TDD band plan. ComReg observed a number of factors in 19/59R, which indicate that the 2.6 GHz primary band plan would be more appropriate.

5.142 In addition ComReg also observes since the publication of 19/59R, that:

- the ECC Decision (05)05 on harmonised utilisation of spectrum for Mobile/Fixed Communications Networks (MFCN) operating within the band 2500-2690 MHz has been amended¹⁰⁵. This amendment

¹⁰⁵ [ECC Decision \(05\)05](http://www.ecodocdb.dk) 5 July 2019, available at: www.ecodocdb.dk

implements only the primary band, as proposed by ComReg in Document 19/59R; and

- The Radio Spectrum Committee has published its draft working document on the draft Implementing Decision on amending Decision 2008/477/EC¹⁰⁶. This working document proposes, amongst other things, to implement:
 - 2×70 MHz paired arrangement in the frequency ranges of 2,500-2,570 MHz (Uplink) and 2620-2690 MHz (downlink) (“2.6 GHz FDD Duplex”); and
 - 50 MHz unpaired arrangement in the frequency range 2570-2620 MHz (“2.6 GHz Duplex Gap”) – which can be used for TDD or base station transmission (downlink only).

ComReg’s updated position

5.143 Having carefully considered all of the submissions received in relation to the 2.6 GHz band and noting the updated information provided by Plum’s field measurements of the aeronautical radar at Shannon (Document 19/124d), ComReg proposes to implement:

- for unfiltered Star 2000 aeronautical radar’s located at Dublin, Shannon and Cork airports:
 - the installation of filters at the aeronautical radar to protect against blocking and intermodulation as a result of the deployment of MFCN base stations; and
- for network operators:
 - imposing a pfd limit on out-of-band emissions of -145 dBW/m²/MHz on MFCN base stations per operator at the radar antenna to address the impact of MFCN spurious emissions;
 - that if, MFCNs are deployed before filters are installed at the aeronautical radar, an additional out of band pfd limit of -83 dBW/m² be imposed¹⁰⁷ to address the impact of blocking and intermodulation effects at radar receivers during the transition period (to be defined); and
 - a coordination zone of 1 km around the aeronautical radar to provide additional protection from MFCN base stations.

¹⁰⁶ [RSCOM19-39 Draft Amending Decision on 2500-2600 MHz](http://www.circabc.europa.eu), available at www.circabc.europa.eu

¹⁰⁷ ComReg continues to actively engage with the IAA and other relevant stakeholders with a view to implementing this mitigation measure with a view to minimise the duration of which out-of-band pfd limit of -83 dBW/m² would need to be imposed.

5.144 In relation to the TA10 radar located at Dublin Airport, ComReg is of the view that the recommendations proposed by Plum are implemented should the TA10 Radar be in operation at the time of the proposed award.

5.145 In this regard, ComReg intends to implement the following:

- **Blocking and intermodulation:** a pfd limit of -93 dBW/m² at the radar receiver should be implemented; and
- **Spurious Emissions:** a pfd limit of -156 dBW/m²/MHz at the radar receiver antenna location should be imposed to address the impact of MFCN spurious emissions.

5.146 In the event that the replacement for the older TA10 radar is situated in an alternative location to the current radar at Dublin Airport, ComReg also proposes to implement a coordination zone of 1 km around the new aeronautical radar location.

5.147 In relation to the older 2.6 GHz band plan, for reasons provided in Document 19/59R and summarised above including consideration of the draft working document on the draft Implementing Decision on amending Decision 2008/477/EC¹⁰⁸, ComReg intends to establish the 2.6 GHz band plan in line with the current 2.6 GHz EC Decision and implement any subsequent amendments that may be published after the award.

5.148 ComReg has updated its Technical Conditions reflecting the updated views of respondents and the updated information relating to compatibility measurements and assessment of the 2.3 GHz and 2.6 GHz band in particular. The review of technical conditions relating to each of the four bands in this award is captured in Chapter 7 below. Annex 14 of this document details the updated Technical Conditions to attach to new licences for each of the four proposed bands included in this award process¹⁰⁹.

5.3 Licence duration

5.3.1 Summary of ComReg's proposal in Document 19/59R

5.149 In Document 19/59R, ComReg considered what would be the appropriate duration for the individual rights of use to the spectrum bands proposed for award.

5.150 These considerations were informed by and based upon on a number of

¹⁰⁸ [RSCOM19-39 Draft Amending Decision on 2500-2600 MHz](https://www.circabc.europa.eu), available at www.circabc.europa.eu

¹⁰⁹ The Technical Conditions proposed for each of the proposed bands were set out in Annex 12 of Document 19/59R.

assumptions, including¹¹⁰:

1. a possible commencement date for rights of use in the 700 MHz, 2.3 GHz and 2.6 GHz bands of 1 December 2020¹¹¹;
2. ComReg's proposal to grant new interim 2.1 GHz rights to Three which would co-terminate with Vodafone's existing 2.1 GHz rights on 15 October 2022 (as outlined in Chapter 5 of Document 19/59R);
3. ComReg's proposal for the 2.1 GHz Band to be awarded in two time slices (as outlined in Chapter 5 of Document 19/59R):
 - i. Time Slice 1: running from 16 October 2022 to 11 March 2027; and
 - ii. Time Slice 2: running from 12 March 2027 until a common expiry date for all rights in the Proposed Bands;
4. ComReg's proposal (as outlined in Chapter 5 of Document 19/59R) to offer liberalisation of existing 2.1 GHz rights to the three licensees from the time of ComReg's substantive decisions on the proposed award and following application:
 - i. For Three and Vodafone - liberalisation would apply to the end of their respective 2.1 GHz rights, i.e. to 15 October 2022;
 - ii. For Meteor, liberalisation would apply to the end of its existing 2.1 GHz rights, i.e. to 11 March 2027; and
5. in the context of the effective management and efficient use of spectrum (and all other things being equal) that:
 - i. co-termination of rights of use within a band is more preferable than not; and
 - ii. co-termination of rights of use being jointly awarded is also more preferable than not.

5.151 In light of these assumptions and observing that the weight of relevant spectrum management practice in Europe has been for durations of between 15 to 20 years, the following 2 options were identified:

¹¹⁰ See section 6.3.5 of Document 19/59.

¹¹¹ See information on Ireland's [700 MHz roadmap](#) as published on the DCCAE website, at: www.DCCAE.gov.ie

- **Option 1:** 15 years for rights in the 700 MHz, 2.3 GHz and 2.6 GHz Bands (possibly commencing on 1 December 2020) and adjusted to a corresponding *shorter* duration for new 2.1 GHz rights. Specifically:
 - 700 MHz, 2.3 GHz and 2.6 GHz Band rights commencing 1 December 2020 and fully expiring 30 November 2035, i.e. an overall period of 15 years; and
 - new 2.1 GHz rights commencing on 16 October 2022 (i.e. beginning of TS1 for the 2.1 GHz Band) and fully expiring 30 November 2035, corresponding to an overall period of approximately 13 years and 1.5 months.
- **Option 2:** 15 years for new 2.1 GHz rights commencing on 16 October 2022 and adjusted to a corresponding longer duration for 700 MHz, 2.3 and 2.6 GHz Band rights. Specifically:
 - new 2.1 GHz rights commencing 16 October 2022 and fully expiring on 15 October 2037, i.e. an overall period of 15 years; and
 - 700 MHz, 2.3 and 2.6 GHz band rights commencing 1 December 2020 and fully expiring 15 October 2037, corresponding to an overall period of approximately 16 years and 10.5 months.

5.152 On balance, ComReg considered Option 1 to be preferable in light of various factors, including that the weight of European practice¹¹² and recent Irish practice for similar bands (i.e. 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz Bands) supported a duration of 15 years and, further, that a shorter duration for new 2.1 GHz rights was not inconsistent with Regulation 9(6) of Authorisation Regulations.

5.3.2 Views of respondents to Document 19/59R

5.153 Three respondents (Eir, Three and Vodafone) did not agree with ComReg's proposed approach. In summary, the reasons provided included that:

- a) a 15 year duration was not appropriate in the context of Article 49 of the EECC (Eir, Three, Vodafone), including Three's view that until the transposition deadline of 21 December 2020, no action should be taken that would "contradict", "undermine", "compromise" the purpose of the EECC;

¹¹² See, for example, BEREC Report on Practices on Spectrum Authorisation, Award Procedures and Coverage Obligations with a View to Considering their Suitability to 5G, BoR (18) 235. See, in particular, section 5.1.

- b) the proposed durations are not sufficient for investment in networks (including 5G networks) (Vodafone and Three), including Three's view that *"it will take a number of years before networks can be rolled out and terminal equipment disseminated to a reasonable population"*;
- c) ComReg's proposals are *"based on a backward looking assessment of European practice and a somewhat circular reference to recent Irish practice"* (Eir), and Three submits that, based on its review of European practice, indicates that *"15 is the minimum, and 20 is more typical"*;
- d) the proposed duration of Time Slice 2 (approx. 8 years) *"is close to the very minimum period required by an operator to be able to invest in relevant technology and earn a positive return on that investment"* (Eir); and
- e) the proposed expiry date (circa 2035) would be too close to the expiry of licences awarded under the 2012 MBSA (i.e. 2030) – thereby creating uncertainties over the future of both sets of spectrum rights and potential investment disincentives - whereas a 20 year duration would put "sufficient space" between these expiry dates (Eir).

5.3.3 ComReg's assessment of respondents' views

5.154 As a preliminary matter, ComReg observes that its assumptions from Document 19/59R remain valid in light of the matters addressed elsewhere in this document.

5.155 ComReg welcomes the views from respondents and outlines its assessment of same below.

5.156 In relation to **issue (a)**, ComReg:

- firstly, and by way of background, recalls its statement at paragraph 2.42 in Document 19/59R that *"With some limited exceptions (see Article 124 of the EECC), Member States have until 21 December 2020 to transpose the EECC into national law.¹¹³ Until then, the existing EU Common Regulatory Framework will continue to apply. However, in developing its proposals for the Proposed Award, ComReg is mindful of the EECC."*;
- observes from Article 124 that Parliament and Council expressly considered which provisions of the EECC ought to apply before the transposition deadline (and clearly identified same) and, by implication,

¹¹³ With the exception of Articles 53(2), (3) and (4), and Article 54 (per Article 124 of EECC).

determined that Article 49 does not apply, either generally or in relation to rights of use to spectrum bands likely to be used early in Europe for 5G (e.g. 700 MHz and 3.6 GHz);¹¹⁴

- in that connection, ComReg recalls that:
 - Parliament and Council, by way of its decision of May 2017¹¹⁵, determined that Member States shall allow the use of the 700 MHz band (a primary 5G band in Europe) by June 2020 (i.e. during the transposition period);
 - Parliament and Council, by way of Article 54(1)(a) of the EECC, obliges Member States to reorganise and allow the use of sufficiently large blocks of the 3.6 GHz band (another primary 5G band in Europe) by 31 December 2020; and
 - as such, it is notable that Parliament and Council did not determine that Article 49 ought to apply to any assignment by Member States of rights of use to those primary 5G bands during the transposition period;
- in light of the above, ComReg does not see particular merit in claims that its proposals are not consistent with the EECC (including “undermining”, “compromising”, “contradicting” the EECC) in circumstances where it would, in fact, be complying with the express transitional provisions of same (i.e. Article 124) by applying the current Common Regulatory Framework, including for licence duration, as intended by Parliament and Council;
- further notes that its substantive decisions on the Proposed Award, including on the appropriate duration of the rights to be awarded, will likely be made before the transposition deadline, and ComReg is obliged to apply the law applicable at juncture. In that context, ComReg further observes that there is considerable discretion afforded the State as to how it may wish to transpose the EECC and is, therefore, mindful of not infringing upon the State’s discretion by adopting any particular interpretation of provisions of the EECC in advance of transposition, including the different approaches identified in Article 49; and
- finally, notes that while there is potential for licences to be issued after the transposition of the EECC, ComReg is required to progress its

¹¹⁴ Indeed, even where Member States transpose the EECC into national law in advance of the transposition date, Article 124 clearly identifies that Member States shall apply those measures from 21 December 2020.

¹¹⁵ DECISION (EU) 2017/899 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union

consultation and decision-making process and ultimate award of rights to these bands in a timely fashion and highlights, in that regard, the timing obligations in relation to the 700 MHz Band.

5.157 In relation to **issue (b)**, ComReg firstly recalls, by way of background:

- its view at paragraph 6.113 of Document 19/59R that there was no material to suggest that longer amortisation periods would be required now for newer technologies that may be deployed in the bands under consideration, compared to those currently used, including the following reported statement by the Vodafone UK CTO¹¹⁶:

“Myth one is site densification. The idea that you have to have more sites for 5G over 4G. That is just not true for the way we are deploying 5G, which is using mid-band spectrum and low-band spectrum. You can build a fantastic 5G network with the same number of base stations.”

- that the present award entails the award of such low-band and mid-band spectrum rights; and
- that it is not proposing interventionist-type coverage obligations that would require a substantial increase in the number of base stations for existing MNOs.

5.158 Given the above, ComReg observes that, for existing MNOs, new technologies are more likely to be deployed at existing sites where:

- a substantial proportion of the CAPEX (e.g. site acquisition, antennas, power, backhaul etc) has already been amortised; and
- based on its Mobile Termination Rate consultations and draft model, an asset life of 8 years is used for base station equipment. ComReg also notes Eir's view in relation to such duration.

5.159 In addition, ComReg notes that respondents did not provide any cogent, extrinsic factual material to indicate otherwise.

5.160 In relation to **issue (c)**, ComReg:

- observes that recent awards in other countries (including the “5G” 700 MHz, 3.6 GHz and 26 GHz Band award in Italy in 2018, the 2.1 GHz award in Finland in 2019 and the 700 MHz award in Romania in 2019) entailed durations of circa 15 years (i.e. 15.5 years for 700 MHz, 14.8 years, and 15 years, respectively) and there does not appear to be any

¹¹⁶ Article entitled “Vodafone UK claims 5G could be the end game” - available at <https://www.mobileworldlive.com/featured-content/home-banner/vodafone-uk-claims-5g-could-be-the-end-game/>

indication from the outcome of these awards that such a duration was insufficient for investment amortisation (e.g. spectrum rights going unsold); and

- recalls that 15 year licences were issued for rights to the 3.6 GHz Band (again noting that this is a primary 5G band in Europe) in Ireland and the overall final prices paid were several times the reserve price (benchmarked on the basis of 15 year duration). In ComReg's view, this outcome does not suggest that a 15 year duration was particularly concerning in terms of providing a sufficient duration for investment amortisation, including for 5G; and
- more generally, refers to the analysis provided above in the context of issue (b).

5.161 In relation to **issue (d)**, ComReg notes that, under the proposed award format, a winning bidder would obtain rights to Time Slice 2 solely only if it expressly bid for such rights (which is presumably would be unlikely to be the case for a new entrant or Vodafone and Three in relation to the 2.1 GHz Band). That is, bidders would be able to submit a packaged bid for rights in both proposed time slices, thereby avoiding the possibility of only obtaining rights in one of those time slices. At the same time, ComReg notes that that this issue may be more relevant for Eir in the context of its 2.1 GHz rights. In that regard, ComReg observes that, given its early liberalisation proposal (see Chapter 4), Eir could avail of this option and deploy newer technologies using its existing 2.1 GHz rights in advance of any new 2.1 GHz rights won in Time Slice 2 and thereby obtain a longer period for investment amortisation for such equipment (i.e. over both Time Slice 1 and 2).

5.162 In relation to **issue (e)**, ComReg notes eir's observation that an expiry date of 2035 would be relatively close to the expiry of the 2012 MBSA licences in 2030. Having carefully considered this issue, ComReg observes that greater spacing between the expiry of the important spectrum rights encompassed by both awards would provide considerable benefits in terms of:

- assisting existing licensees in terms of their investment planning cycles and financing;
- providing more evenly-spaced opportunities for market entry, noting the desirability for new entrants to obtain both coverage- and capacity-type spectrum and, further, that all currently available coverage-type spectrum is encompassed by the present award (i.e. 700 MHz band) and 2012 MBSA licences (800 MHz and 900 MHz Bands);

- providing more time for any material developments (e.g. market, technological, legal etc) to occur between these awards and for such developments to be taken into account (and, if appropriate, suitably addressed) in the development of subsequent award processes; and
- similarly, greater spacing would contribute to the effective management of the radio spectrum by providing more time for ComReg to develop, consult upon and implement such important spectrum awards, including more time for interested parties to engage with such processes.

5.163 In terms of an appropriate spacing between these awards, ComReg observes that a 20 year duration for rights of use to the 700 MHz, 2.3 GHz and 2.6 GHz Bands (with a corresponding shorter period for new 2.1 GHz rights) would provide approximately 10 year spacing between the expiry of 2012 MBSA licences (in 2030) and the expiry of the former rights (circa 2040). Further, and assuming¹¹⁷ that any new rights to the 2012 MBSA bands would also be of 20 years duration, this would provide a further 10 year spacing between these rights and those granted under the present award.

5.164 Bearing in mind the potential benefits identified in paragraph 5.162 above, ComReg considers that a 10 year spacing between the expiry of rights in the 2012 MBSA and rights granted under the present award, which would be facilitated by 20 year durations of rights to the 700 MHz, 2.3 GHz and 2.6 GHz Bands (and corresponding shorter duration for 2.1 GHz rights), would be appropriate in the context of its statutory objectives in present circumstances.

5.3.4 ComReg's revised proposal and preliminary decision on licence duration

5.165 Following consideration of responses received and other material before it, ComReg's revised proposal and preliminary decision for licence duration is as follows:

- 20 years for rights in the 700 MHz Duplex, 2.3 GHz and 2.6 GHz Bands and corresponding shorter duration for new 2.1 GHz Band rights. For illustrative purposes, assuming a commencement date for these rights of 1 December 2020, specifically:
 - 700 MHz Duplex, 2.3 GHz and 2.6 GHz Band rights commencing 1 December 2020 and fully expiring 30 November 2040, i.e. an overall period of 20 years; and
 - new 2.1 GHz Band rights commencing on 16 October 2022 (i.e. beginning of TS1 for the 2.1 GHz Band) and fully expiring 30

¹¹⁷ For present purposes only and without prejudice to its future consideration of this issue.

November 2040, corresponding to an overall period of approximately 18 years and 1.5 months.

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Chapter 6

6 Award Type and Format

6.1 Preferred Auction format

6.1.1 Summary of ComReg's view in Document 19/59R

6.1 In Section 7.3 of Document 19/59R, ComReg identified and examined a number of potential auction formats for assigning rights of use across the bands under consideration. In particular, ComReg described a number of risks¹¹⁸ as likely to arise in this award process, and assessed the extent to which of these auction formats mitigate those risks while ensuring spectrum rights are awarded to those users who value it the most.

6.2 Having considered the DotEcon Award Design Report and responses to Document 18/60 (including the Nera Report), ComReg was of the preliminary view that the CCA would be best suited to deal with the risks associated with this award because it would:

- avoid aggregation risks, by allowing bidders to bid for packages of lots, under the guarantee that bidders would only be assigned a combination of lots if they specifically made a “package bid” for same;
- mitigate substitution risks by:
 - allowing bidders to submit multiple, mutually-exclusive bids for alternative packages;
 - selecting winning bids and prices in a way that would ensure that bidders prefer their own winning outcome to that of any other bidder given the final prices;
 - allowing bidders to switch across lot categories in response to price changes during the open stage, without creating an unacceptable risk of gaming or strategic behaviour that weakens competition;
 - allows bidders to switch aggregations of lots across different bands without risk of fragmentation across bands;

¹¹⁸ Aggregation risks, gaming opportunities, strategic demand reduction, inefficiently unsold lots, substitution risks, bidder information deficits and complexity.

- being sufficiently transparent and providing opportunities for bidders to pool information through the bidding process to mitigate any concerns about bidder information deficits;
- mitigating incentives for bidders to strategically reduce demand, which could result in an inefficient assignment and reduce service provision in downstream markets;
- allowing for the possibility of non-uniform prices, which might be the only way of supporting an efficient outcome when valuations are synergistic, and avoiding inefficiently unsold lots;
- mitigating the risk of inefficiently unsold lots by allowing bidders to offer, through supplementary bids, to take those lots that would remain unsold at clock prices; and
- destabilising tacit collusion and thereby reducing the risk of same.

6.1.2 Views of respondents to Document 19/59R

6.3 Three does not support the use of the CCA in the Proposed Award for a number of reasons, including:

- aggregation risks should not be a particular concern for this award because:
 - the total quantity of spectrum assigned following the award would be 1100 MHz across 9 bands;
 - time slices are not necessary (see below) and the aggregation risk across time slices is a construct arising from ComReg's proposal for the 2.1 GHz Band;
- a CCA can lead to grossly asymmetric price outcomes for the same spectrum rights and, in its view, if the outcome is that bidders pay significantly different prices for equivalent lots, then the award fails to treat all bidders fairly;
- CCA auctions lack, in its view, the transparency required for a bidder to know at any point how much they are likely to pay for a particular package.
- ComReg has, in its view, not provided evidence that other award mechanisms are open to gaming and the proposal to set minimum prices close to expected market value reduces any incentive for demand reduction.

- bidders are unlikely to reduce demand and concede spectrum if this would compromise their ability to compete downstream.
- bidders may be tempted to exaggerate demand so as to retain pricing pressure on rivals and prevent outcomes where they must pay more than stronger rivals.
- the proxy used to determine how much Eir would be required to pay for a liberalisation fee would be undermined by significant variations in price.
- DotEcon recommended the use of an SMRA-Clock hybrid format in a recent award in the Netherlands and highlight reasons why a CCA or other second-price auction mechanisms are not suitable where asymmetric caps apply.
- ComReg has not stated clearly what information policy it is proposing to provide to bidders.
- the use of a CCA format combined with what it terms asymmetric caps between bidders (see below) poses a risk to the efficiency and fairness of the process.

6.4 Vodafone is of the view that open, simultaneous multi-round auctions (CCA or SMRA) are the most efficient way to assign new spectrum. In that regard, if ComReg is minded to use a CCA it should be kept to a more standard design.

6.5 Eir has concerns about ComReg's proposal to use a CCA format for this auction. In summary, Eir contends that:

- the CCA lacks transparency in that there is uncertainty over the difference between the amount bid and the final price which creates a governance challenge for some bidders.
- opportunity cost pricing can lead to price asymmetries that favour stronger bidders.
- there is a significant risk, in its view, that some bidders would be unable or unwilling to submit 'knockout bids' with the consequent risk that they would not win the spectrum they should. For example, Eir opines that:
 - budget constrained bidders may have to determine whether to bid full value for smaller packages and less than full value for larger packages or bid as much as they can for larger packages and less than full value for smaller packages.
 - bidders could unexpectedly come out of the auction with no

packages, favouring stronger bidders who can make knock-out bids.

- 6.6 Eir notes that other alternative formats such as pay-as-bid formats mitigate some of the risks. Of these formats, a CMRA and SMRA would not be appropriate, in its view, as price asymmetry may arise in the CMRA while the SMRA constrains the ability of bidders to switch between substitute packages of spectrum. Alternatively, Eir favours the use of a SCA format that uses a relaxed activity rule similar to that typically used in CCAs and CMRAs.
- 6.7 Finally, Eir states that DotEcon rejects the need for a combinatorial auction format in its advice to the Dutch Ministry and instead recommends a simpler pay-as-bid format, highlighting the simplicity and certainty they give to bidders. Eir suggests that similar considerations apply in the context of the Irish award.
- 6.8 Imagine agrees that spectrum should be assigned by way of an open, appropriate competitive auction format.
- 6.9 Mr. Young agrees and supports ComReg's award format proposals.

6.1.3 DotEcon updated view

Aggregation risk and package bidding

- 6.10 In relation to concerns around package bidding, DotEcon believes that there is potential for a significant degree of aggregation and substitution risk in the Proposed Award.
- Bidders may require a minimum amount of spectrum in excess of the lot size within any given band, so there are likely complementarities across lots within bands;
 - Bidders may desire a combination of lots across multiple bands (e.g. a mix of sub-1 GHz and higher frequency spectrum, which might be needed by a bidder without a wide portfolio of existing spectrum holdings across different bands), in which circumstances there would be complementarities across spectrum bands;
 - The various higher frequency bands are likely to be (in the long-run) substitutable, and bidders are likely to have valuations for a range of alternative packages with different combinations of spectrum; and
 - Bidders may wish to switch multiple, complementary lots from one band to another.

- 6.11 Further, DotEcon observes that allowing bidders to submit bids for a wide

variety of spectrum combinations means there is greater scope that smaller participants in the award would be able to fit in with the demands of the larger bidders and acquire some spectrum rights of use. Package bidding is helpful for entrants for whom it might be important to acquire a particular portfolio of spectrum rights.

- 6.12 DotEcon notes that concerns about excessive complexity in the CCA and time slicing fails to recognise that package bidding allows bidders to focus their bids solely on packages that would lead to licences spanning both time slices. While the auctioneer faces some complexity this is not relevant to bidders. The CCA also has the added benefit of being familiar to a number of potential participants in the award following the recent 3.6 GHz Award.

Eir's alternative award format

- 6.13 In relation to Eir's suggestion of a simple clock auction (SCA), DotEcon notes that such an approach is inappropriate for a number of reasons.

- Only the bids submitted in a particular round are assessed to determine whether the auction can end and what the winning outcome is. This is particularly problematic in scenarios where there is a large number of lots over a variety of substitutable categories.
- It limits the extent to which bidders' preferences over alternative packages can be accounted for to determine an efficient outcome
- The SCA is susceptible to unsold lots where there are complementarities across lots and aggregate demand can suddenly drop from being greater than supply to being below supply, even with small price increments.
- In contrast, the CCA (and CMRA) allows bidders to submit a range of bids expressing preferences over different packages and deal with the risk of unsold lots far more effectively.

- 6.14 Further, DotEcon notes that it is not possible to adopt a relaxed activity rule in a SCA without introducing the potential for gaming. Allowing bidders to increase their demand if some conditions on relative prices are met would create a wide range of gaming possibilities allowing bidders to hide their demand or distort prices.

Dutch Award

- 6.15 DotEcon outlines that there is no reason for the award format recommendations to be the same as recommended for the Dutch award as the same conditions do not apply in the Irish award. The difference in circumstances and objectives lead to different conclusions in the two cases. In particular, DotEcon notes that:

- the Dutch government had, among others, an explicit objective of simplicity and generating a realistic revenue for the government.
- ComReg's primary objective is promoting competition in order to provide for, among other things, an efficient outcome. It also has a more nuanced view on complexity and is not especially concerned with auctioneer complexity if there are potential efficiency benefits to be gained.
- the specific recommendation of a hybrid SMRA in the Dutch case was based on the view there were no significant synergies between the lots on offer and no explicit concern about possible complementarities for new entrants. The DotEcon report to the Dutch government was extremely clear that in the case of strong complementarities a combinatorial format is required to guarantee efficient allocation.
- in contrast, it is likely that there will be significant complementarities across lots within the Proposed Award (whether time slicing is used or not) for at least some potential bidders.

Asymmetric prices

6.16 In relation to concerns about asymmetric prices, DotEcon notes that there is no reason to suggest that such prices are discriminatory if they arise because bidders start from different positions and therefore are likely to face different levels of competition from each other and are not starting in symmetrical positions. The competition faced by Three is derived from demand for spectrum from other bidders who may wish to catch up with Three, in which case it would face relatively strong competition for spectrum and asymmetric prices could be expected in an efficient award which would not be unfair as bidders are generally bidding for different things in terms of overall holdings.

6.17 In relation to the impact of competition caps on prices paid by winning bidders, DotEcon notes that bidders are in different starting positions by virtue of existing spectrum holdings and as a result are likely to differ in terms of spectrum they can acquire (i.e. make bids on). DotEcon notes prices that reflect such a situation is appropriate because it ensures that bids are not made that reflect any expectation of acquiring market power by cornering the available spectrum. Even if such bids were not successful, they could affect winning prices, leading to others paying more as a result of uncompetitive outcomes being allowed.

Knock out bids

6.18 In relation to Eir's concerns that the 'knockout bids' might be beyond the reach of certain bidders, DotEcon notes that if the knockout bid level for the final clock package were above a bidder's valuation for that package, it would be irrational

for that bidder to bid in excess of its valuation, as that would expose the bidder to a risk of winning the package and paying more than the package was worth to it (in which case the bidder would have been better off if it had lost entirely).

Budget constraints

- 6.19 DotEcon notes that although the CCA may create some difficulties for bidders with internal governance issues and/or managing budget constraints, it is unclear how severe these problems are in practice. Regardless of the specific format, there will typically be some need for bidders to assess what they can realistically win within their budget constraint, and possibly to update such an assessment during the auction. DotEcon notes that the issues facing budget constrained bidders are broadly analogous with similar issues they face in other formats.
- 6.20 Separately, DotEcon also notes it is undertaking a separate study for ComReg looking at whether ancillary information could be given to bidders during the clock rounds that would allow them to anticipate if they might need to pay the full amount of a bid if won. If this approach proves feasible, DotEcon advises that it could be implemented through a minor revision in the information policy of the Proposed Award.

Strategic demand reduction

- 6.21 DotEcon notes there are a range of potential bidders in addition to MNOs and the incentives for strategic demand reduction can be greater for weaker bidders who might anticipate needing to reduce demand later in the auction. Further, DotEcon notes the following.
- In an SMRA or SCA these bidders may have strong incentives to reduce demand early in an attempt to end the auction at lower prices as continuing to compete for lots they do not expect to win would only serve to increase the price of lots they do win;
 - The CCA provides much better protection against strategic demand reduction than pay-as-bid-formats as the price a winning bidder will ultimately pay is largely unaffected by its own bids; and
 - DotEcon notes the example of Three in the Danish 2.6 GHz auction (2010) as an example of how the CCA can be more effective than pay-as-bid formats.

Price driving

- 6.22 In relation to Three's view that strategic bidding could lead to inefficient outcomes, DotEcon notes that price driving strategies in the proposed CCA

where there is limited information about a competitors demand would be risky. Under ComReg's proposal, bidders would find it difficult to isolate any part of another bidders demand. The risk of winning an unwanted package should act as a significant disincentive for such behaviour.

6.23 Further, DotEcon notes that since spectrum access fees are a sunk cost as far as pricing decisions in downstream markets are concerned forcing rivals to pay more for spectrum is unlikely to allow a bidder to charge more for its own services making it far from clear whether there are any long run commercial benefits from engaging in such behaviour.

6.1.4 ComReg's assessment of respondents views

6.24 ComReg assesses the views of respondents under the following headings.

- Aggregation Risks;
- Dutch Multi-Band Award;
- Asymmetric prices;
- Discriminatory pricing;
- Gaming and strategic bidding;
- Transparency and information; and
- Alternative auction formats.

Aggregation Risks

6.25 In relation to Three's suggestion that aggregation risks are not of concern in this award due to the large amount of spectrum already assigned, ComReg notes that such concerns were previously discussed in Section 7.3.1 of Document 19/59R. In particular, ComReg noted that:

- the Proposed Award is not designed solely with MNO's in mind and ComReg has to consider the possibility of alternative bidders who may not have need for the larger quantities of spectrum that may be required by MNOs.
- while existing MNOs have current spectrum holdings that would reduce the impact of not obtaining their minimum requirements, this is not true of all bidders, particularly new entrants.

6.26 ComReg agrees with the views of DotEcon that a CCA helps to support entry and/or participation by smaller bidders. In that regard, ComReg notes that there

is a variety of potential users¹¹⁹, particularly given the large amount of spectrum available, and package bidding is necessary for such bidders because acquiring a particular portfolio of spectrum rights of use is likely to be important.

- 6.27 ComReg is conscious that it should not preclude or discourage entry through the choice of an auction format or specific auction design features that might expose smaller bidders and/or new entrants to greater risks than necessary. For example, two non-MNOs (Imagine and Dense Air) were assigned rights of use in the 3.6 GHz Award Process (which used a CCA) which may not have occurred had an alternative format been used.
- 6.28 ComReg would also note that while aggregation risk might not be a significant risk for Three given that it has the largest spectrum holdings in the Irish market, it is likely to be more relevant for smaller bidders and new entrants. Therefore, ComReg notes that concerns from incumbent MNOs needs to be balanced against the benefits that package bidding is likely to have on smaller bidders and new entrants, whether or not such bidders are ultimately successful in winning spectrum rights of use.
- 6.29 In relation to time slices, in Document 19/59R, ComReg noted that the risk of winning rights of use in one Time Slice but not the other is likely to be of particular concern for all bidders. ComReg has addressed concerns in relation to Time Slices in Chapter 4, including Three's suggestion of using two lot categories as an alternative to time slices. However, ComReg agrees with DotEcon that aggregation risks would still arise regardless of whether time slicing is ultimately required because new entrants and smaller bidders would still be exposed to not winning a portfolio of spectrum that may be necessary for entry and bidders more generally are likely to require a minimum number of lots or a certain multiple of lots within any given band.
- 6.30 For the avoidance of doubt, ComReg agrees with DotEcon that even if time slices were not required in this award (e.g. if all existing 2.1 GHz licensees surrender its licenses), it would still be minded to provide for package bidding as complementarities within and across bands are likely to remain important for some bidders and a significant aggregation risk would remain for smaller bidders and potential new entrants.

DotEcon advice to the Dutch Ministry

- 6.31 In relation to advice provided to the Dutch Ministry of Economic Affairs, ComReg agrees with DotEcon that the difference in circumstances and objectives lead to different conclusions in both awards. In particular, ComReg notes the

¹¹⁹ As set out in the 'Spectrum for Award' RIA a variety of users other than mobile operators are potentially interested in obtaining spectrum rights of use.

objectives set by the Dutch Ministry which were as follows (which included an explicit simplicity objective)¹²⁰.

- Ensuring an efficient assignment of spectrum;
- Generating a realistic revenue for the government;
- Simplicity;
- Transparency; and
- Freedom of choice

6.32 DotEcon's advice to the Ministry in that award was that the CCA did not contribute towards the Dutch objectives of simplicity or transparency.¹²¹ However, ComReg's objectives are, among other things, to assign spectrum rights of use for electronic communications services in a manner that furthers ComReg's statutory objectives including, promoting competition, promoting the interests of users, and ensuring the effective management and efficient use of spectrum in Ireland (See Annex 2). ComReg does not have a specific simplicity objective, except to the extent that excessive complexity would compromise its ability to provide for an efficient assignment. Further, ComReg does not have a revenue raising objective, therefore issues around generating a realistic revenue are not relevant for ComReg in determining an appropriate award format.

6.33 ComReg agrees with DotEcon that it has a more nuanced view of complexity/simplicity compared to the Dutch regulator. Section 7.3.5 of Document 19/59R assessed complexity and among other things concluded that the CCA did not create excessive complexity and that much of the complexity resides with the auctioneer. The CCA has already been used in Ireland for the 2012 MBSA and more recently the 3.6 GHz Award in 2017, so many potential bidders are likely to be familiar with its features.

6.34 Importantly, ComReg intends to replicate the detailed bidder training programme successfully used in the 3.6 GHz Award, including an auction workshop presentation, the use of bidder playgrounds (allowing bidders to run their own mock auctions), mock auctions, and access to the winner and price determination software. ComReg is of the view that the bidder training programme as previously used has been highly successful in ensuring bidders have a good understanding of the format and bidding process in advance of the auction. While there is significant computational complexity on the auctioneer

¹²⁰ Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum Prepared for the Dutch Ministry of Economic Affairs July 2019 – p13.

¹²¹ Ibid, p63.

side and practical considerations arising from bidder training, ComReg is of the view that the CCA is not overly complex for bidders in practice and any such risk is entirely manageable.

- 6.35 ComReg notes that two non-MNOs in the 3.6 GHz award who did not have prior experience of CCAs, up to that point, were assigned rights of use in that award. In response to Document 18/60, Imagine (a winning bidder in 3.6 GHz) observed that *“Given the recent experience of the CCA auction process of 3.5GHz Imagine believes that CCA is a suitable mechanism for the auction and allocation of this spectrum.”*
- 6.36 ComReg assesses concerns in relation to transparency below but notes that it is currently working on whether additional information can be provided over the course of clock rounds to assist bidders in assessing the financial exposure resulting from their bids. If ComReg decides to provide such further information, this will be set out as part of ComReg’s information policy during the award (i.e. Information Memorandum)
- 6.37 ComReg also agrees with DotEcon that the recommendation to the Dutch regulator was based on the view that aggregation risks were not material as there were no significant synergies between the lots on offer, meaning that a combinatorial auction format would be unnecessary. Alternatively, such risks are highly relevant in the Irish case for the reasons set out in Section 7.3.1 of Document 19/59R and above. In particular, aggregation risks are likely to arise because of the need for time slices and to not preclude or discourage participation by new entrants or smaller bidders through a specific auction design feature.
- 6.38 Finally, ComReg notes that there was no specific concern expressed by the Dutch regulator about the risk that smaller bidders might face complementarities across lots even if incumbents did not face material complementarities. Therefore, ComReg agrees with DotEcon that the same conditions do not apply to Ireland where synergies are present and package bidding is required to support an efficient assignment and encourage participation from smaller bidders and new entrants.

Asymmetric Prices

- 6.39 ComReg notes that concerns in relation to asymmetric prices as noted by respondents were previously addressed in Section 7.3.4 of Document 19/59R. Therein, ComReg noted that:
- bidders paying comparable amounts is not an objective of the Proposed Award in its own right. Rather, one of ComReg’s main objectives is to ensure the efficient assignment and use of the radio spectrum.

- uniform pricing (i.e. all bidders paying a common price per lot) may not be compatible with an efficient assignment as it is likely to boost incentives to distort bidding behaviour to moderate prices and soften competition.
 - a uniform price (i.e. the same per lot price for all bidders) may result in lots going unsold unnecessarily or being assigned inefficiently to a bidder who is not the bidder that values them most, simply because in some cases it is impossible to achieve an efficient outcome with uniform prices when there are complementarities between lots.
- 6.40 NERA (on behalf of Three) accepts that paying comparable amounts is not an objective but claims that ComReg has not provided an efficiency justification for the use of a CCA and the second price rule. ComReg notes that it already has provided a variety of efficiency justifications for using a CCA and the associated pricing rule.
- 6.41 **First**, in Section 7.3.3 of Document 19/59R, ComReg discusses in detail its concerns in relation to strategic demand reduction. The assessment is not repeated here, however, the CCA and opportunity cost pricing provides bidders with incentives to compete for additional spectrum and provides good incentives¹²² for bidders to make bids that reflect their actual relative valuations for the different packages that bidders consider they could win. ComReg outlined a variety of research showing that strategic demand reduction incentives are strong in uniform price auctions. ComReg considers that strategic demand reduction is potentially a material issue for this award for the reasons set out in Para 7.49 of Document 19/59R, including the large amount of spectrum available and potential participation of weaker bidders.
- 6.42 In Document 19/59R, ComReg previously noted that the incentives for strategic demand reduction may be stronger for bidders who expect to eventually have to reduce demand in response to price increments. In particular, bidders who expect to have to reduce demand in later rounds may decide to do so earlier as competing for additional spectrum would ultimately increase the price paid for the reduced number of lots. This could lead to an inefficient outcome and reduced competition as such bidders might ultimately have been able to acquire additional spectrum, but refrained from doing so through fear of having to potentially reduce demand later and pay a higher price as a result of competing for additional spectrum.
- 6.43 Given the range of potential bidders for the proposed award (including smaller incumbents and potential new entrants), strategic demand reduction is a very

¹²² Although there are some incentives to deviate from straightforward bidding to moderate winning prices, the pricing mechanism (i.e. MRC pricing) minimises these incentives across bidders.

real concern in this award. In particular, ComReg notes that smaller bidders may participate in this award noting that that two non-MNO bidders in the 3.6 GHz Award obtained relatively small amounts (compared to MNOs) and may be interested in similar sized packages in this award.

- 6.44 In that regard, DotEcon notes that the CCA provides much better protection against strategic demand reduction than pay as bid format as the price a winning bidder will ultimately pay is largely unaffected by its own bids. The use of a CCA allows bidders to bid up to their maximum willingness to pay for larger packages and test its position as the marginal bidder without fear of affecting the price it might have to pay for a lower number of lots later in the auction. This would not be possible in a SMRA and smaller bidders in particular would have had strong incentives to reduce demand earlier in the auction.
- 6.45 ComReg notes that the pricing methodology in a CCA (i.e. opportunity cost pricing¹²³) creates incentives to bid in line with valuations as winning prices are determined by competition from other bidders. If a bidder competes for a larger amount of spectrum in line with its preference and does not win, this does not drive up the cost of acquiring a smaller package. Regardless of any asymmetry in pricing, winners pay the least amount reasonably possible given the competition they each face.
- 6.46 ComReg notes the Danish 2.6 GHz auction (2010) as laid out by DotEcon is a helpful example of how the CCA can be more effective than pay-as-bid-formats in mitigating the risk of strategic demand reduction. In that award, Three was likely to have been the marginal bidder in that award and could reasonably have expected that it would have to settle for a number of lots below the maximum allowed. The auction was, however, run using a CCA, which provided the opportunity for Three to bid for additional spectrum and test its position as the marginal bidder without fear of affecting the price it might have to pay for a lower number of lots.
- 6.47 **Second**, as noted in Section 7.3.4, the risk of inefficiently unsold lots is avoided through the use of a combinatorial auction that does not impose linear pricing. Winners and prices are established taking into account the whole range of bids submitted, with the consequence that (if bidders reflect their full demand profiles in their bids) lots will only remain unsold if there is no additional value that can be achieved by assigning them. Auction formats that are prohibited from setting different prices per lot for different packages may fail to produce an efficient outcome, potentially with unsold lots that could have been allocated had price uniformity not been imposed by the format choice.

¹²³ Pricing on the basis of each winner's individual opportunity costs is usually called Vickery pricing. The MBSA and the 3.6 GHz award did not use simple Vickrey pricing, but rather a more complex variation called minimum revenue core (MRC) pricing.

- 6.48 Both cases referred to above have important efficiency and spectrum management implications because, under other formats bidders could end up with less spectrum rights of use that would have been the case in an efficient assignment or the award ends with unsold lots. Given that the spectrum proposed for assignment is particularly important for the delivery of end user services and given its limited supply, any harm arising from inefficiently unsold lots or strategic demand reduction would likely be high which would not be desirable. ComReg therefore believes that the preferred auction format should minimise the likelihood of such scenarios.¹²⁴
- 6.49 In relation to Three's suggestion that the risk of strategic demand reduction can be addressed by setting reserve prices sufficiently high, and that ComReg already proposes to set minimum prices close to the expected market value ComReg notes the following.
- 6.50 First, ComReg does not propose to set minimum prices "*close to the expected market value*", Rather, ComReg derives a conservative estimate of the minimum price that balances the minimum price being set too high so as to choke off demand of serious bidders against the risk of the price being so low that there is participation by frivolous bidders and/or facilitates collusive behaviour (whether tacit or explicit).
- 6.51 Second, ComReg already addressed the suggestion that minimum prices can be set at a high level in order to deter strategic demand reduction in Section 7.3.3 of Document 19/59R where it was noted that such an approach increases the risk of choking off demand by setting minimum prices too high. This would require setting reserve prices close to market-clearing levels with an associated risk of spectrum going unsold inefficiently. In previous awards, ComReg has always been clear about uncertainty in estimates of spectrum value used to set reserve prices and has taken a cautious approach to ensure that risks of spectrum going unsold are controlled. For example, ComReg notes that in the case of MBSA (2012) and the 3.6 GHz Award (2017) multiple respondents, prior to those awards, submitted that minimum prices were too high, when final prices ended at many multiples of the reserve price. Therefore, it is simply infeasible to set reserve prices close to final prices.

¹²⁴ Note that ComReg typically assesses the likelihood of such risks on a case by case depending on the circumstances pertaining to a particular award. For example, in the recent 400 MHz Award, ComReg acknowledged that the award format (SCA with exit bids) was susceptible to inefficiently unsold lots (even with the use of exit bids). However, such a risk was relevant to Part B only (Part A had only one 2 x 3 MHz Lot), and it concerned a small amount of spectrum (ten 2 x 100 KHz lots) where alternative frequencies were available. Importantly, it was not used to provide downstream services that could harm consumers. In that regard, ComReg considered the inefficiency risk and associated impacts to be small. However, in the current case the risk of inefficiency and the impacts of same are orders of magnitude higher and ComReg is of the view that this is an important consideration for this award that needs to be addressed,

- 6.52 Separately, in relation to concerns expressed by Three that bidders are unlikely to reduce demand if this would compromise their ability to compete downstream, ComReg notes that different bidders will be in different positions and some may have greater need for spectrum than others. Bidders are also likely to express a preference for a variety of different packages each of which it would be happy to be assigned at or below valuation.
- 6.53 It is still the case that if an auction format is used where incentives for demand reduction are strong, this has the potential to change bidders' choices of spectrum targets. This is most likely for bidders who might have competed for a larger package of spectrum, but expect that they are likely to win a smaller amount. However, a bidder would still be satisfied if it won those lower valuation packages given it expressed a binding bid for same. Therefore, ComReg is most concerned about the potential for incentives for challengers to compete for spectrum being undermined, rather than for incumbent bidders. The 3.6 GHz award demonstrates the potential for a CCA to give challengers strong incentives to compete for spectrum, which in this case led to two winners who were not traditional MNOs.

Discriminatory pricing

- 6.54 Given the above discussion on asymmetric pricing, NERA (and Three) submit that ComReg discriminates based on the price different bidders have to pay. NERA notes that "*As ComReg acknowledges, the CCA uses a discriminatory pricing rule that may lead to bidders paying very different prices for the same thing.*" For the avoidance of any doubt, ComReg notes that it has not acknowledged that a CCA uses a "*discriminatory pricing rule*". The CCA uses an opportunity cost pricing rule to promote efficient outcomes which may result in non-uniform prices. ComReg considers such an approach to be non-discriminatory for the reasons set out below.
- 6.55 As noted by DotEcon there is no reason to suggest that asymmetric prices are discriminatory if they arise because bidders start from different positions and face different levels of competition from each other. The competition faced by Three is derived from the demand for spectrum from Eir, Vodafone, non-MNO bidders and entrants. These bidders may wish to catch up with Three, in which case it might face relatively strong competition for spectrum. However, in this case asymmetric prices might be expected in an efficient award and are not unfair, as bidders are generally bidding for different things in terms of overall holdings.
- 6.56 Alternatively, if two bidders within a CCA are in the same situation, winning the same packages and facing the same competition from rival bidders, they will pay the same winning prices. However, if bidders win different packages, or face different levels of competition from rivals, they may have different winning

prices. This is not discriminatory as they are in objectively different situations.

6.57 Different bidders have different demand profiles and value packages differently. Some bidders may only be interested in a very specific set of packages or just one package (e.g. in order to support a specific use case). Other bidders might be interested in a wide variety of different packages (e.g. to support multiple different use cases, or due to substitutability of different spectrum portfolios) including some packages larger than whatever ultimately turns out to be its winning package; such bidders may reduce demand during the clock rounds or be assigned a smaller package first bid for in the supplementary bids round. Under such conditions, opportunity cost pricing can lead to bidders paying different amounts for similar spectrum packages due to those bidders facing different amounts of competition from their rivals. For example:

- if a bidder competes for a variety of packages (including larger and smaller packages) but wins a smaller package, the larger packages for which it placed bids for (but did not win) can impose an opportunity cost on other bidders.
- bidders who do not have a valuation for spectrum additional to its winning package creates little or no opportunity costs for others who may therefore pay relatively less compared to the amounts of their bids.

6.58 The resulting prices are not discriminatory as the bidders are not in symmetric positions at the point when prices are being determined. Therefore, the second price rule would not give rise to discrimination in the treatment of undertakings providing ECN and ECS because, whilst all bidders would compete in the same award, in relation to determining prices, the situation of some bidders may be materially different from others.

6.59 ComReg's primary concern is efficient assignment of spectrum, subject to ensuring downstream competition is effective. This means that each winner (and group of winners) needs to pay at least its opportunity cost, otherwise there would be alternative higher value users and an efficient assignment would not have been achieved. If bidders are then to pay the least amount possible subject to this requirement of paying at least opportunity cost (which is what the second price rule for a CA does), then this means that if bidders winning similar packages impose different opportunity costs, they will pay different amounts, as the example above demonstrates.

6.60 DotEcon notes that equalising winning prices would require that the bidder with the lower opportunity cost to pay **more** than its opportunity cost, as the other bidder paying less than its opportunity cost is not compatible with efficient assignment. However, full price equalisation might not be possible if this led to the bidder with the lower opportunity cost paying more than its bid. Further, if bidders expect to pay more than their opportunity cost, then they have

incentives to reduce their bids in order to reduce their prices; therefore, bidding incentives are polluted by this approach.

- 6.61 As noted by DotEcon, the minimum revenue core pricing used in the CCA has the specific property that incentives to deviate from bidding at valuation are minimised, which promote efficient allocation. Therefore, ComReg considers that if it sought to impose a constraint that bidders winning similar packages, but facing different amounts of competition, paid similar amounts, this would be incompatible with the objective of efficient assignment.

Asymmetric pricing and competition caps

- 6.62 Further, ComReg agrees with the views of DotEcon that Three and NERA are incorrect to suggest that the asymmetric prices arising from the interaction of competition caps with the CCA are also discriminatory. In particular, DotEcon notes that Three is not starting from the same position as the other bidders, because it already has access to more spectrum than the other operators and therefore valuations (and prices) are likely to vary as a result. DotEcon notes that there is no particular reason to expect or require the award process to lead to uniform pricing given the asymmetric starting positions.
- 6.63 Given the clear requirement for existing holdings to be considered in order to prevent distortions to downstream competition¹²⁵, the range of bids that Three can make would likely be different to other bidders particularly in relation to the 700 MHz Duplex where other bidders have greater scope to bid for additional spectrum. At some point, (where some bidders can bid for more spectrum and Three cannot) this will result in Three imposing less of an opportunity cost on those bidders compared to the opportunity cost others impose on Three.
- 6.64 However, this arises not because of the award format but because of Three's existing spectrum holdings which need to be considered in order to avoid an accumulation of spectrum rights that could distort downstream competition. As noted above, an efficient assignment requires that those that are assigned spectrum pay at least the opportunity cost of that spectrum and the pricing mechanism logically takes account of this in order to provide for an efficient outcome. DotEcon notes that Three's argument is in effect a claim that other bidders with smaller existing spectrum holdings should pay more - above their respective opportunity costs - simply because Three's greater existing holdings

¹²⁵ ComReg has already assessed whether existing spectrum holdings should count towards any spectrum competition in Section 7.7.6 of Document 19/59R. In summary, ComReg notes that the ability of an operator to compete in a market is determined to a certain degree by the overall amount of spectrum the operator holds across all bands. Taking account of existing spectrum holdings limits the ability of those bidders who already hold large amounts of spectrum (like Three) to unreasonably strengthen incumbency advantages given that they would use those holdings in the post-award competitive landscape. See also Section 6.5 below 'Competition Caps'

of spectrum limit the extent to which it can compete for additional spectrum.

- 6.65 Therefore, in order to achieve an efficient assignment (an objective of this award), asymmetric prices would be an entirely appropriate outcome if the opportunity cost imposed on Three (or any other bidder) is higher than that imposed on other bidders. As noted by DotEcon in relation to the 700 MHz Duplex, any asymmetry in pricing would not be the result of discriminatory treatment of Three because it is clearly not in a comparable position with other MNOs in terms of sub-1 GHz holdings. Other MNOs with less spectrum than Three to start with might have a greater appetite for spectrum in order to catch up with Three and/or to simply meet a growing need for spectrum; in this case Three will naturally face more competitive pressure and higher prices if it wants to increase its own holdings.
- 6.66 Furthermore, there is no particular reason to expect that auction outcomes in which winners pay somewhat different amounts would have an adverse effect on competition in downstream service markets, as when service pricing decisions are made, spectrum access fees are a sunk cost and the primary determinant of pricing is the competitive environment. Whilst it is always possible for licensees to return spectrum licences to avoid future spectrum usage fees, these fees are fixed (in real terms) and not dependent on the auction outcome. Therefore, provided measures such as competition caps are in place to avoid downstream competition being undermined, there is no direct causality from spectrum award outcomes to service price; rather it is reasonable to expect that causality flows in the opposite direction, with anticipated downstream competition conditions influencing spectrum value and hence auction outcomes.
- 6.67 ComReg notes that the use of opportunity cost pricing in the award is, among other things, objectively justified in the context of ComReg's statutory framework due to effect in underpinning efficient assignment. In particular, ComReg considers that it would accord with ComReg's objective to promote competition because, among other things, it would accord with and further ComReg's obligation/objective of promoting/ensuring the efficient use of spectrum by ensuring that those that are assigned spectrum pay at least the opportunity cost of that spectrum.
- 6.68 Furthermore, ComReg observes it would accord with the relevant regulatory principles which ComReg is obliged to apply in pursuit of its objectives. In particular the preferred award format would:
- not give rise to discrimination in the treatment of undertakings providing ECN and ECS for the reasons described above; and
 - be proportionate because, among other things, there do not appear to

be less onerous means by which these objectives and principles could be achieved because:

- ComReg assessed four alternatives auction formats in Chapter 7 (Document 19/59R) and considered that the CCA best mitigates the risks assessed therein.
- ComReg has assessed alternative formats and design elements suggested by respondents to Document 19/59R and concluded that these would not achieve its objectives.
- As noted by DotEcon, it does not impose a burden on any potential bidder as Spectrum Access Fees are a sunk cost as far as pricing decisions in downstream markets are concerned.
- The price paid would be lowest price compatible with the loser not wanting to make a higher bid exceeding the price paid by the winner.

Gaming and strategic bidding.

6.69 NERA contends that a much bigger risk to efficiency is that bidders manipulate their bid amounts as a tool to put price pressure on rivals. ComReg notes that it has already addressed such concerns in Section 7.3.2 of Document 19/59R where it outlined that the risk of such price driving in a CCA is low for a number of reasons, including that while price driving is theoretically susceptible it relies on unrealistic assumptions about the information that one bidder has about the likely valuations and bidding strategy of other bidders. In practice, the risk associated with price driving strategies is more related to whether bidders have sufficient information about their competitors' likely demand/valuations, so that they can be relatively assured that they will not win with price-driving bids. Neither NERA nor Three have responded to these views.

6.70 In that regard, ComReg agrees with DotEcon that under its proposal, bidders would find it difficult to isolate any part of another bidders demand. With a CCA, all bids are binding and taken into account as potential winning bids, so if a bidder attempted to place bids beyond valuation with the aim of increasing the price paid by other bidders, there is a material degree of risk¹²⁶ that it might win a package it does not want or at a higher price than it would be willing to pay. This should act as a significant disincentive for such behaviour, especially given that the direct commercial benefit to a bidder from making others pay more for

¹²⁶ In particular, there is a final price cap to limit the extent to which bidders can express an incremental demand for lots in excess of their final primary package at a value exceeding the lot prices applying in the final primary bid round. This measure makes the final primary bids more committing. At the same time, greater flexibility is provided for bidders to bid for their most preferred packages in each primary bid rounds through provisions for relaxed primary bids.

spectrum is far from clear. Further, as noted by DotEcon, spectrum access fees are a sunk cost as far as pricing decisions in downstream markets are concerned and spectrum usage fees do not depend on the auction outcome, so forcing rivals to pay more for spectrum is unlikely to allow a bidder to eventually charge more for its own services.

- 6.71 ComReg also notes that any attempts at price driving or strategic bidding would likely be limited to situations where bidders had a reasonable expectation of demand from rival bidders. Such expectations are typically informed by legacy situations where issues around migration and continuity of services might arise. However, as previously noted in Chapter 4 (and noted by Three)¹²⁷ such issues around continuity of service are limited given the availability of other frequencies and licences do not expire until 2022 and 2027. Further, the asymmetric holdings in the 2.1 GHz Band (arising from the 2014 merger) make it difficult for bidders to determine whether rivals want more or less 2.1 GHz holdings given they are now operating in a three-operator market. Therefore, it becomes difficult for bidders to accurately assess each other's demand with the necessary level of accuracy.
- 6.72 Finally, ComReg notes that NERA's approval of Three's two lot category proposal would seem to run counter to its concerns surrounding price driving given that each bidder would be far more likely to accurately determine which lot category each bidder would prefer under that structure. In particular, it is feasible that only Eir would appear to have any interest in the second lot category 2027 - 2040.
- 6.73 Finally, ComReg notes that this problem would arise regardless of what auction format were used. Therefore, this possibility cannot be pointed to as an adverse consequence of the use of a CCA.
- 6.74 In relation to Three's submission, that ComReg has not provided evidence that other award mechanisms are open to gaming, ComReg notes that Section 7.3.2 of Document 19/59R assessed in detail how **five potential auction formats** (SBCA, SMRA, SCA, CCA and CMRA) are open to the risk of gaming in various ways. ComReg does not repeat that assessment here but notes that Three has not provided any evidence that ComReg's assessment of those formats was in any way incorrect

Transparency and Information

- 6.75 In relation to Eir and Three's concern that the CCA lacks transparency and

¹²⁷ "The situation is not the same as in 2012, when bidders with 900 and 1800 MHz blocks had potential high value for short term extensions to ensure 2G service contiguity. With 3G approaching its end date, operators have more flexibility to adapt to the loss of this spectrum and, with three instead of four incumbents, the risk of any MNO not winning back valuable 2.1GHz spectrum is anyway low"

creates a governance challenge for some bidders, ComReg notes that it addressed such concerns in para 7.112 -7.114 of Document 19/59R ('Budget constraints'). In light of its experience in recent awards and the successful use of CCAs, especially the 3.6 GHz award that resulted in parties other than the three MNOs winning spectrum, ComReg considers such concerns to be relatively minor, especially under the proposed activity rules. Further, training provided by ComReg would help bidders to learn how to make good use of the information disclosed during the open stage in order to determine their final set of supplementary bids.

- 6.76 Notwithstanding, ComReg notes that such concerns may be more relevant in large multi-band awards, where budget constraints and governance issues are more likely to arise. In that regard, while ComReg considers such concerns to be relatively minor and manageable, it is currently exploring whether additional information can be provided to bidders in terms of the maximum price a bidder would have to pay given certain clock bids. ComReg intends publishing on this matter early in the new year and ComReg may seek feedback from interested parties prior to publishing the draft Information Memorandum. For the avoidance of doubt, however, ComReg does not make any promise or guarantee that changes to the information policy will be made as a result.
- 6.77 In relation to Eir's concerns that so called 'knockout bids',¹²⁸ might be beyond the reach of certain bidders, DotEcon notes that the main consequence of the existence of knockout bids (which are a mathematical consequence of the activity rules of the CCA) is that they permit bidders to bid less than the full amount of their valuation for their final clock package, yet still have a guarantee that they will win this package (subject to not raising bids for other packages too much). In the event that the knockout bid level for the final clock package were above a bidder's valuation for that package, it would be irrational for that bidder to bid in excess of its valuation, as that would expose the bidder to a risk of winning the package and paying more than the package was worth to it (in which the case the bidder would have been better off it had lost entirely).
- 6.78 Therefore, if a bidder wants to bid at its knockout bid level and is unable to do so because of a budget constraint, then that bidder would also be unable to bid at its valuation. Therefore, contrary to Eir's assertion, the existence of knockout bids in fact aids bidders with budget constraints, as they provide a means for such a bidder to lock in its final clock package without having to bid at its full valuation.
- 6.79 Furthermore, ComReg notes it is important to recognise that budget constrained bidders face challenges in bidding within most auction formats and usually need

¹²⁸ ComReg typically provides details of this in the Information Memorandum under the heading 'Final Price Cap for bidding strategies in the Supplementary Bids Round'.

to form some view about what they are likely to be able to win within their budget to formulate a bidding strategy. For example, and as noted by DotEcon, in SMRAs and clock auctions, budget constrained bidders face particularly complex trade-offs if they compete for additional lots, as this may increase prices that they would still need to pay if they subsequently dropped to a smaller number of lots. Therefore, some of the problems for budget constrained bidders are intrinsic to being budget-constrained, rather than specifically related to the auction format used. No amount of additional information or design elements can entirely overcome this.

Alternative auction proposals

- 6.80 In relation to Eir's suggestion of a SCA (simple clock auction) format that uses a relaxed activity rule, ComReg agrees with the views of DotEcon that this would not provide bidders with enough flexibility to express their demand for different combinations of packages. Further, such an approach is open to the risk of inefficiently unsold lots and measures to mitigate this are insufficient to ensure an efficient outcome in an important award.
- 6.81 ComReg notes that a SCA was one of the five auction formats assessed in Document 19/59R. In summary, ComReg noted that a SCA was not appropriate for this award because the SCA may easily lead to inefficiently unsold lots, especially when bidders have synergistic valuations, and may still create switching impediments for bidders who may wish to switch between packages with different eligibility. The SCA provides relatively strong incentives for strategic demand reduction, which may increase the risk of an inefficient outcome, including the possibility of inefficiently unsold lots if multiple bidders reduce demand at the same time. As previously noted, ComReg is particularly concerned that this incentive might be strongest for smaller bidders, which could discourage participation by parties other than the traditional MNOs.
- 6.82 Further, ComReg agrees with DotEcon that it is not possible to adopt a relaxed activity rule in the SCA without introducing potential for gaming. In particular, simply allowing bidders to increase their demand if some conditions on relative prices are met would create a wide range of gaming possibilities, allowing bidders to hide their demand and/or distort prices. At the same time, trying to mitigate this problem by adopting a more complex approach to evaluating bids to include consideration of bids relevant to setting relative caps under a relaxed activity rule simply turns the auction into something resembling a CMRA. Therefore, we consider that the suggestion of an SCA with relaxed activity rules is not suitable for the proposed award as it would increase the risk of gaming and there could still be demand expressed in previous rounds for unsold lots that occur at the end of the auction but at a lower price per lot. A bidder might be willing to be assigned additional lots to those won at the final round price, if those lots were available at a lower previous round price. Therefore, there

remains a risk of lots going inefficiently unsold.

6.1.5 ComReg's updated position

6.83 In light of the above, and having considered the latest views of DotEcon and the responses to Document 19/59R, ComReg is of the preliminary view that the CCA is the auction format best suited to deliver on its objectives and deal with the considerations that arise in the proposed award process.

6.2 Lot size of generic spectrum

6.2.1 Summary of ComReg's view in Document 19/59R

6.84 In Section 7.4 of Document 19/59R, ComReg set out its view that it would be appropriate to offer spectrum in its smallest usable blocks to provide bidders with greater flexibility to aggregate spectrum to fit a bidder's demand profiles. In summary, ComReg noted:

- If lots are only offered in lot sizes greater than the smallest usable block it could result in lots being inefficiently distributed across bidders or remaining unsold.
- The relevant European harmonisation measures for mobile broadband use of the proposed bands specify frequency arrangements of 5 MHz blocks.
- A CCA allows for the aggregation of lots by bidders into packages of spectrum that would constitute larger blocks in line with their respective business plans.

6.85 ComReg was therefore of the preliminary view that frequency generic spectrum should be offered using lot sizes of 5 MHz or 2x5 MHz because such lot sizes accommodate all likely types of users and technologies given that smaller lots can be aggregated to satisfy larger demands.

6.2.2 Views of respondents to Document 19/59R

6.86 Eir sets out the following in relation to the lot size of generic spectrum.

- It believes the lot size in the 700 MHz Duplex should be set at 2x10 MHz as this is consistent with ComReg's coverage proposals to achieve at least 30 Mb/s at the cell edge.
- It questions whether a 2x5 MHz block size in the 700 MHz Duplex is compatible with the EECC and its objectives to encourage very high capacity networks.

- It agrees with a generic lot size of 5 MHz for the 2.3 GHz band.
- It agrees with ComReg's proposals for 2x5 MHz frequency generic lots in the 2.6 GHz Band.

6.87 Vodafone agrees that 5 MHz (or 2x5 MHz) is the best block size to use as this allows bidders to plan for guard bands, where required, as well as larger traffic carrying assignments.

6.2.3 ComReg's assessment of respondents' views

6.88 In relation to Eir's view that a lot size of 2x10 MHz would be appropriate for the 700 MHz Duplex, ComReg notes that this approach would not be a reasonable measure in the context of promoting of competition and encouraging the efficient use and the effective management of the radio spectrum. This lot size would reduce the flexibility for bidders to bid for the packages of spectrum they require to provide services.

6.89 The ability of operators to compete flexibly for different packages of spectrum promotes competition in downstream markets as they are likely to have different requirements across the various bands and would be able to differentiate themselves from rivals downstream, to a greater or less extent, depending on the rights of use that are ultimately assigned. In that regard, ComReg notes the following.

- A lot size of 2x10 MHz means that Eir or Vodafone would not have the opportunity to reduce the sub 1 GHz band asymmetry to Three, even if it was efficient to do so. Under, ComReg's current proposals both Eir and Vodafone can bid for up 2x15 MHz in the 700 MHz Duplex.
- ComReg would be unable to set any effective competition caps for the sub 1 GHz Bands because a cap of 2x20 MHz would run the risk of creating an extreme asymmetry in the sub 1 GHz Bands. A cap at 2x10 MHz would be too restrictive.
- In effect, the lot size would become a cap on what bidders could be assigned with the result that (absent any competition from non-MNOs) bidders would be unable to either increase or decrease demand effectively, negating the need for an auction. There would be no competition during award and 2x10 MHz would likely be assigned to each MNO at reserve price, and most likely to be below the opportunity cost of the spectrum.
- It would reduce opportunities for new entry as potential new entrants (to the band or the market) would not have the option of acquiring the

smallest useable blocks of spectrum, noting ComReg's view that it should not preclude or discourage any entry through the choice of an auction format or specific auction design features that might reduce the opportunities for entry (even if a small possibility). For example in the 2012 MBSA, Three was assigned a single 2x5 MHz lot.

- 6.90 Conversely, a lot size of 2x5 MHz provides for a range of alternative outcomes. In Document 19/59R, ComReg noted that offering spectrum in its smallest usable blocks provides bidders with the greatest flexibility to aggregate spectrum blocks to fit a bidder's demand profile. In that regard, ComReg notes that the CCA allows for the aggregation of lots by bidders into packages of spectrum that would constitute larger blocks in line with their respective business plans, without any risk of bidders winning only a subset of this demand. Therefore, bidders would be able to bid for blocks of 2x10 MHz if they so wish.
- 6.91 Further, in response to Eir's observations regarding licence conditions, ComReg points Eir to Section 8.4.6 of Document 19/59R. In summary, a winning bidder of 2x5 MHz in the 700 MHz Duplex would be subject to a 20 Mbit/s throughput instead of 30 Mbit/s throughput for winners of 2x10 MHz or more.

6.2.4 ComReg's updated position

- 6.92 ComReg remains of the preliminary view that frequency-generic spectrum should be offered using lot sizes of 5 MHz or 2x5 MHz, as appropriate.

6.3 Frequency-Generic or Frequency-Specific Lots

6.3.1 Summary of ComReg's view in Document 19/59R

- 6.93 In Section 7.5 of Document 19/59R, ComReg set out its view as to whether it would be appropriate to offer lots on a frequency-specific or frequency-generic basis.

700 MHz

- 6.94 ComReg was of the preliminary view that there are no material, systematic differences in the characteristics/value of different blocks in the 700 MHz Duplex; each 5 MHz or 2x5 MHz lot within each band is likely to be of similar value. Therefore, ComReg proposed that all rights of use in the 700 MHz Duplex Band would be assigned on a frequency-generic basis.

2.1 GHz

6.95 Eir's existing 2.1 GHz licence of 2x15 MHz of spectrum until 2027 would necessitate splitting the remaining frequencies in Time Slice 1 into two categories (3 blocks below and 6 blocks above Eir's frequency). ComReg observed that this would limit the scope for a winning bidder being assigned contiguous spectrum within the band. This would create a number of issues, including:

- adding complexity to the award and reducing the scope for assigning contiguous spectrum;
- presenting bidders with the issue of deciding how much frequency-generic lots in the 2.1 GHz band would be worth to them without knowing whether those frequencies would be assigned on a contiguous or non-contiguous basis; and
- if Eir is assigned 2.1 GHz rights of use in Time Slice 2, it would likely be required to transition from its existing frequencies.

6.96 In order to address such matters, ComReg proposed that Eir would be required to participate in the assignment stage of the Proposed Award to determine the location of Eir's current spectrum rights in the 2.1 GHz Band. Further, ComReg noted that any relocation costs incurred by Eir would be examined by ComReg to determine if such costs are objectively justified and proportionate.

6.97 All lots would therefore be assigned on a frequency-generic basis.

2.3 GHz

6.98 In relation to the 2.3 GHz Band, ComReg was of the preliminary view that a frequency-specific lot may be necessary for two different frequency ranges.

- a) the frequency range 2390 – 2400 MHz has a lower in block EIRP limit of 45 dBm / 5 MHz to ensure coexistence with systems above 2.4 GHz; and
- b) the frequency range 2307 – 2327 MHz is used by Eir's Rurtel network to provide fixed telephony services in rural areas as part of its Universal Service Obligation.

6.99 In relation to (a), ComReg notes that using a lower maximum EIRP would give a lower transmission and coverage range and may be more suitable to some network deployments types over others. Therefore, ComReg was of the preliminary view that a frequency-specific lot may be necessary for those frequencies.

6.100 In relation to (b), ComReg observed that the preferred packaging approach (frequency specific or generic) would depend on the nature and extent of any

migration by Eir of its RurTel network out of the 2.3 GHz band, in advance of the Proposed Award. ComReg envisaged three broad migration scenarios one of which would apply depending on the potential circumstances that pertains at the time of the award,

2.6 GHz Band

6.101 Two 5 MHz restricted blocks (2570 – 2575 MHz and 2615 – 2620 MHz) would be required in the 2.6 GHz Band where FDD and TDD spectrum blocks are adjacent to one another. Given that bidders may value the 2570-2575 and 2615 – 2620 frequency ranges differently to the other lots in the 2.6 GHz Duplex Gap, ComReg was of the preliminary view this spectrum should be considered on a frequency-specific basis.

6.102 Finally, following the main stage (i.e. the primary and supplementary bid rounds of the Proposed Award) ComReg proposes that the award would proceed to the assignment of specific frequencies to winners.

6.3.2 Views of respondents to Document 19/59R

2.3 GHz Band

6.103 Eir agrees with ComReg's proposals for a 30 MHz lot (2300 - 2330 MHz), and a 10 MHz lot (2390 – 2400 MHz) with the remainder of the band being made available in lots of 5 MHz.

6.104 Vodafone states that if no progress is made on an alternative solution for RurTel then it agrees that it is best to proceed with frequency-specific lots as set out in Document 19/59R.

2.6 GHz Band

6.105 Eir agrees with ComReg's proposals for generic 2x5 MHz (FDD) and 5 MHz (TDD) generic lots and two frequency specific lots where FDD and TDD lots meet.

Assignment stage

6.106 Vodafone submits that the process of running a primary stage with frequency generic lots and a separate assignment round has worked well and where possible this design should be used.

6.107 Eir has no objection to the principles proposed by ComReg which are consistent with the approach successfully applied in the MBSA.

6.108 Three submits that ComReg should ensure that if Eir is a winning bidder for any 2.3 GHz spectrum then during the assignment round, the award should give

priority to maximising the extent to which the same spectrum is assigned to Eir as is used for RurTel.

6.3.3 Updated Information

6.109 Chapter 7 provides a full Eir RurTel Network Update. However, in summary:

- in relation to Kerry, there are no active customers, all base station sites are deactivated and RurTel licences have been cancelled.
- in relation to Galway, there are 4 active customers. A reduction of 50% since the publication of Document 19/59R.
- in relation to Donegal, there are 76 active customers in the Donegal area and Eir continues to assess opportunities to provide alternate voice solutions for these customers

6.110 The total number of active RurTel customers is now 80, comprising:

- active customers in the area of Galway, who are supported by 6 licences. ComReg understands that this consists of 6 repeater stations and 4 customer stations.
- active customers in the area of Donegal who are supported by 21 licences. ComReg understands that this is a more complex network consisting of a number of repeater stations and customer stations.

6.3.4 ComReg's assessment of respondents' views

6.111 ComReg notes respondent's general agreement with the approach by ComReg set out in Document 19/59R.

6.112 In relation to Three's view that if Eir is a winning bidder for any 2.3 GHz spectrum, its frequencies should overlap with the RurTel frequencies, ComReg notes the following.

6.113 **First**, the assignment stage only concerns frequency generic lots. If sufficient migration does not occur a frequency-specific lot (2300 - 2330 MHz) would be made available and all bidders would have the opportunity to bid on that lot or not.

6.114 **Second**, in the event of full migration prior to the Proposed Award there would be no reason to have any assignment stage principle that provided for Eir to be assigned 2.3 GHz rights in the former RurTel frequencies.

6.115 **Third**, to the extent that the frequencies 2305 – 2330 MHz are treated as generic but still delivering RurTel in Donegal (i.e. partial migration), ComReg

agrees with Three that an assignment principle should maximise the extent to which Eir's winning 2.3 GHz lots, if any, overlap with those RurTel frequencies as Eir would be best placed to manage any interference issues. Further, it would provide the correct incentives for Eir to fully migrate RurTel users from the 2.3 GHz Band post award.

6.116 In doing so, ComReg notes that the extent of any overlap would depend on the number of 2.3 GHz lots assigned to Eir. In particular, ComReg notes that regardless of how much it was assigned, Eir's assignment would be contiguous beginning at 2300 MHz, and assignments to all other winning bidders would begin immediately above Eir's spectrum rights of use.

6.117 **Fourth**, and for the avoidance of doubt, ComReg considers the restrictions on those frequencies to be minor such that bidders other than Eir could be assigned those frequencies if Eir was assigned less than 30 MHz or not assigned any 2.3 GHz frequencies. In those scenarios, the assignment of the specific frequencies to other bidders would depend on the interaction of other bidders in the assignment round.

6.118 ComReg will specify the assignment principle along with the other principles outlined in Document 19/59R in the draft Information Memorandum which is due to be published in Spring 2020.

6.3.5 ComReg's updated position

6.119 In relation to RurTel, ComReg observed in Document 19/59R that the preferred packaging approach would depend on the nature and extent of any migration by Eir of its RurTel network out of the 2.3 GHz band going forward, in advance of the Proposed Award. Of particular relevance, ComReg noted that:

- in the event of full migration by Eir sufficiently in advance of the Proposed Award then the lots in the frequency range 2307 – 2327 MHz could be treated as frequency-generic spectrum
- in the event of partial migration, ComReg noted that should Galway and Kerry be fully migrated before the Proposed Award or shortly afterwards, then the lots in the frequency range 2307 – 2327 MHz could be treated as frequency-generic spectrum

6.120 All other partial migrations and the no migration scenario would require the 2300 – 2330 MHz range to be treated as a single frequency-specific lot available to all bidders

6.121 As noted above, all RurTel users have migrated from Kerry, with a small number of users remaining in Galway. Despite the progress, further migration of the remaining users from Galway would be required in order for the frequency range

2307 – 2327 MHz to be treated as frequency-generic spectrum. ComReg is hopeful that with the assistance of Eir this can be achieved. In that regard, ComReg will continue to monitor progress in the 2.3 GHz Band and will update stakeholders accordingly in the next response to consultation.

6.4 Unsold lots

6.4.1 Summary of ComReg's view in Document 19/59R

6.122 In Section 7.6 of Document 19/59, ComReg outlined its preliminary view that it should retain its discretion regarding how it might treat any unsold spectrum lots depending on the factual circumstances arising from the Proposed Award, save that it intends that unsold lots will not be assigned for a reasonable period after the process has ended.

6.4.2 Views of respondents to Document 19/59R

6.123 ComReg did not receive any responses in relation to unsold lots.

6.4.3 ComReg's updated position

6.124 Therefore, for the purpose of the Proposed Award, ComReg remains of the preliminary view that it should retain its discretion regarding how it might treat any unsold spectrum lots depending on the factual circumstances arising from the Proposed Award, save that it intends that unsold lots will not be assigned for a reasonable period after the process has ended.

6.5 Spectrum Competition Caps

6.5.1 Summary of ComReg's proposals in Document 19/59R

6.125 In Section 7.7 of Document 19/59R, ComReg identified both a sub-1 GHz cap and an overall cap for the Proposed Award.

6.126 ComReg also observed that there does not appear to be any strong basis to support claims that the existing asymmetry in spectrum holdings (between MNOs) is materially harming competition. The existing asymmetries could also be seen as a floor below which a cap may impose too much of a restriction on the flexibility of bidders to obtain sufficient rights of use.

6.127 ComReg also assessed whether it should take into account existing spectrum holdings (in Section 7.7.6). In summary, taking account of existing spectrum holdings in bands other than those to be assigned when applying a competition cap limits the ability of those bidders who already hold large amounts of spectrum (relative to competitors) to strengthen incumbency advantages and

asymmetries as a result of the spectrum they win in the award.

6.128 In relation to a sub-1 GHz competition cap, ComReg was of the preliminary view that a 70 MHz competition cap (2x35 MHz) would be appropriate for the Proposed Award because:

- compared to a cap of below 70 MHz, it would not unduly restrict the range of demand and, by minimising the potential for lots to be inefficiently unsold and therefore unused, it would better ensure the efficient use of spectrum; and
- compared to a cap above 70 MHz, it would ensure a minimum of three winners obtaining at least 2x5 MHz each, thereby reducing any risk of asymmetric sub-1 GHz holdings post-auction.

6.129 In relation to an overall cap, ComReg was of the preliminary view that a cap in the range between 375 – 420 MHz would be appropriate for the Proposed Award because:

- A cap of 375 MHz would approximately retain the level of asymmetry between MNOs (in terms of total MHz) present after the Merger and the 3.6 GHz Award (i.e. 85 – 100 MHz or 8-9% of spectrum holdings); and
- A cap of 420 MHz would potentially allow an increase in the asymmetry to 160 MHz and above (or around 20% of available spectrum holdings). This would be double the absolute asymmetry prior to the award but that asymmetry as a percentage of total holdings available would be similar to the time of the Merger.

6.5.2 Views of respondents to Document 19/59R

6.130 Five respondents (Eir, Imagine, Vodafone, Mr Liam Young, Three) provided submissions on ComReg's spectrum cap proposals, which are outlined below.

Eir

6.131 In summary, Eir:

- agrees with ComReg's proposal to apply both a sub-1GHz and an overall competition cap and for those caps to take into account existing spectrum holdings;
- considers that none of the spectrum proposed for award, with the exception of 2.1 GHz spectrum, is sufficiently different from the other mobile spectrum already held by operators to justify applying spectrum caps that relate solely to the spectrum to be awarded;

- considers that 2.1 GHz spectrum is important to MNOs existing operations and submits that an additional 2.1 GHz specific cap of 50 MHz (in both time slices) is required to prevent any subset of the 3 MNOs acquiring all available 2.1 GHz spectrum;
- agrees that the sub-1 GHz cap should be set at 70 MHz;
- strongly believes that the overall cap should not exceed 375 MHz and, further, that this level would only be acceptable on the basis of its 2.1 GHz band specific cap proposal; and
- in support of its preference for an overall cap of not more than 375 MHz, submits that:
 - ComReg has not conducted a proper assessment of competition in the mobile market and it questions the logic of maintaining the same degree of asymmetry between the three existing MNOs;
 - ComReg's proposed approach compares the position of Eir and Three and, by ignoring the position of Vodafone, would allow Vodafone to increase its asymmetry relative to Eir; and
 - The approach used to measure asymmetry is incorrect in its view. Eir proposes an alternative approach of measuring asymmetry using the difference between the largest and smallest holdings as a percentage of the largest holding. Using this new metric according to Eir shows that the current asymmetry is 34% and using a cap of 420 MHz could increase that to more than 50%.

Imagine

6.132 In summary, Imagine agrees with the principle of applying a cap but disagrees with ComReg's approach because:

- ComReg only considered two factors in regard to caps - namely asymmetries spectrum holdings between mobile operators and the potential for unsold lots;
- ComReg should instead focus more on whether there is sufficient spectrum available for other operators;
- an overall cap of 375 – 420 MHz would allow the incumbent MNOs to acquire a very significant portion of the new spectrum, which, in its view, defeats the purpose of having a cap at all;
- a cap in the 400 - 420 MHz range would ensure further asymmetry and

lead to dysfunctional market incentives in the form of spectrum hoarding;
and

- a cap in the 385 - 395 MHz range would allow all spectrum resources to be consumed by existing MNOs.

6.133 Instead, Imagine proposes that:

- caps should be based on no one operator acquiring more than 25% of the total available spectrum (which would suggest an overall competition cap of 290 MHz); and
- if this resulted in spectrum being unsold, then an (unspecified) mechanism could be implemented to allow the cap to be breached.

6.134 Finally, Imagine submits that an overall cap of 375 MHz would be the least worst option because this will ensure that there is adequate flexibility in bidding for all interested operators without promoting a situation where an unwelcome concentration of spectrum can arise.

Vodafone

6.135 In summary, Vodafone:

- agrees that competition caps are a necessary part of the award process to ensure that extreme asymmetric outcomes are not produced;
- supports ComReg's proposal to have separate competition caps for sub-1 GHz band [sic] and an overall cap;
- agrees that 70 MHz would be appropriate for the sub-1 GHz cap for the reasons provided by ComReg in Document 19/59R;
- considers the range identified by ComReg for the overall cap to be reasonable; and
- supports an overall cap of 420 MHz.

Mr Liam Young

6.136 Mr Liam Young agrees with and supports ComReg's proposed competition caps.

Three

6.137 Three did not agree with ComReg's proposal and expressed numerous concerns which, for ease of reference, have been broadly grouped together

under the following headings (noting there will be overlaps between these groupings):

- concerns expressed of a more general nature;
- requests for clarification on how the proposed caps would operate;
- more specific concerns regarding the proposed sub-1 GHz competition cap; and
- concerns raised in respect of various regulatory principles and statutory provisions (not otherwise addressed above).

6.138 Three raised a number of **concerns of a more general nature**, including that, in its view:

- i. ComReg has not provided a legal basis for the inclusion of what it calls “asymmetric caps” (i.e. caps which take into account existing spectrum holdings);
- ii. Taking into account existing spectrum holdings would particularly discriminate against Three with no objective or reasoned basis for such treatment;
- iii. the existing spectrum asymmetry does not warrant intervention by ComReg (and that view is shared by both ComReg and DotEcon) and, further, ComReg has not:
 - identified the market issue it is seeking to remedy;
 - identified any ‘extreme asymmetry’ in the market currently or provided sufficient evidence/justification that the proposed competition caps are necessary to prevent against this happening as an outcome of the proposed award (i.e. why the proposed caps are needed to prevent extreme spectrum asymmetry);
- iv. ComReg has not demonstrated that the proposed measure which disadvantages Three is proportionate;
- v. the proposal is a new departure for ComReg to count spectrum from bands that are not included within the award against caps;
- vi. at previous awards Three was unaware that spectrum assigned in those awards could be considered in future competition caps; and
- vii. ComReg has not carried out an adequate Regulatory Impact Assessment which it claims is required by Ministerial Policy Direction 6;

6.139 Three also requested **clarification** on the following aspects of the proposed caps in its view:

- viii. which existing assignments are to be counted towards the cap and the reasons why;
- ix. there is a single geographical region proposed for this award compared to a regional 3.6 GHz Award and ComReg has not made clear what spectrum in that award is counted towards the cap;
- x. it seems that Eir's existing 2.3 GHz band spectrum holdings are not counted towards the proposed caps, even though this band is to be included in the award;
- xi. how the proposed caps would apply during different time periods over the duration of future licences. In particular:
 - o licences for 9 of the 12 2.1 GHz lots expire in 2022. Three assumes these would not apply for the cap, leaving only Eir's 2.1 GHz existing spectrum counting towards the cap;
 - o 800 MHz, 900 MHz and 1800 MHz licences expire in 2030 at least 5 years before the end-date of the new licences. Existing licensees would be penalised for having held those licences even after they expire; and
 - o similarly, the 3.6GHz licences expire in 2032.

6.140 Three raised a number of more specific concerns in relation to the **proposed sub-1 GHz cap**, including that in its view:

- xii. the 900 MHz Band is not a direct substitute for the 700 MHz Duplex and there are significant differences that will lead to different uses over time;
- xiii. ComReg has set out to restrict Three's ability to bid for 700 MHz spectrum (to two lots) when compared to the two other MNOs (to three lots) and it states that it is unclear what ComReg's reasoning or justification is for placing such a restriction on Three;
- xiv. the proposed sub-1GHz cap is asymmetric in its view and disadvantages Three which is unfair and inequitable and no legal or objective reasoning has been provided for this treatment. In support of these claims, Three submits that:
 - a. Three is the only operator that could be left in a position to win no spectrum which would lead to an extremely asymmetric outcome in the 700 MHz Duplex; two of the existing MNOs can express a value

for up to three lots compared to two for Three, meaning Three's value for a third lot cannot be reflected in the price determination for the other MNOs. In particular, and when coupled with a CCA format, Three claims that this may lead to "extreme" differences in the prices paid by the MNOs for equivalent lots, due to Three's inability to express a valuation for a third lot in its bids;

- b. the proposed sub-1 GHz cap, together with the proposed CCA format, would result in "perverse outcomes", including that:
- bidders with "predictably higher values for a third lot are advantaged over others", such that "Vodafone (higher market share) would be advantaged versus Eir (lower market share) and Three (also high market share but starts with more sub-1 GHz spectrum)";
 - Three faces paying an opportunity cost it cannot reciprocate and, it may now be cheaper and potentially more tempting for Vodafone to try to reduce Eir to one block as it no longer has to pay the opportunity cost of denying a third block to Three. Further, with the proposed overall cap, Eir has more flexibility to bid for surplus spectrum "owing to its higher cap and lower capacity needs" and may be tempted to overstate its demand in other bands, as a way to match Vodafone's greater pricing power at 700 MHz"; and
- xv. in light of its concerns, Three suggests that a 2x10 MHz cap should apply to the 700 MHz Duplex.

6.141 Three raised a number of more specific concerns in relation to the **proposed overall competition cap**, including that in its view:

- xvi. a cap that accounts for existing holdings introduces "*acceptable asymmetry between bidders*" by enabling one "*large bidder*", Eir, to bid for significantly more spectrum than its two rivals and Vodafone more flexibility than Three; and
- xvii. in the context of a CCA, the overall cap would create a "*huge asymmetry in the ability of MNOs to impose prices on each other*" because Three cannot express its full value of being denied incremental spectrum;
- xviii. Three submits that a cap that accounts for existing holdings introduces an unacceptable asymmetry between bidders and it would enable Eir to bid for significantly more spectrum than its rivals.

6.142 In light of its submissions, Three further claims that ComReg's proposals are

not compatible with **other aspects of the regulatory framework** and, in particular:

- the regulatory principle of promoting efficient investment and innovation in new and enhanced infrastructures;
- the regulatory principle of promoting regulatory predictability by ensuring a consistent regulatory approach;
- Regulation 11 of the Authorisation Regulations regarding:
 - giving due weight to the need to maximise benefits for users and to facilitate the development of competition; and
 - granting such rights of use on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to the achievement of the objectives set out in section 12 of the Act of 2002 and Regulations 16 and 17 of the Framework Regulations.

6.143 Finally, and, for bands above 1 GHz, there should be a symmetric cap of 150 MHz based only on spectrum available in the award.

6.5.3 DotEcon's updated view

6.144 DotEcon considers respondents' submissions in Section 4.3 of its report and interested parties are referred to same. A summary of DotEcon's assessment is outlined below.

Existing holdings and substitutability

6.145 DotEcon does not agree with Three's suggestion that existing holdings should not be taken into account and observes that downstream competition is affected by relative total holdings of substitutable or complementary spectrum, not just the amount won in a particular award. If bidders participate in an award with very different starting positions, it is necessary to impose competition caps that account for existing holdings in order to protect against the potential for highly asymmetric post-award total holdings.

6.146 In relation to substitutability between bands, DotEcon notes that:

- the fact that some bidders are more restricted than others in terms of the amount of spectrum they can win is not a justification for a symmetric cap.
- long term use is more relevant for assessing substitutability and the 700

MHz, 800 MHz and 900 MHz Bands are likely to be substitutes for providing coverage.

- the 700 MHz and 900 MHz Bands can be considered substitutable and it is appropriate to consider them together as part of a sub 1 GHz cap.

Asymmetric prices

6.147 DotEcon notes that Three and NERA (on behalf of Three) are incorrect to suggest that the asymmetric prices arising from the combination of the caps and the CCA are discriminatory. In summary:

- Three is not starting from the same position as the other bidders given its existing holdings. Therefore, Three is not bidding for the same thing as the other MNOs and may also face a different level of competition from its rivals.
- Three's argument for equal prices is in effect a claim that other bidders with smaller existing spectrum holdings should pay more - above their respective opportunity costs.
- Three's claim that it is unfair that it is the only MNO that faces winning nothing in the 700 MHz band also falls down if viewed in the context of total sub-1 GHz holdings rather than rights of use in the Proposed Award.

Relevant market and asymmetric outcomes.

6.148 DotEcon notes that the competition caps as proposed are designed to prevent highly asymmetric spectrum holdings after the award that might negatively affect competition in the relevant downstream market(s) (e.g. mobile services).

6.149 While there is potential for some of the spectrum (in particular the higher frequency bands) to be used for services other than mobile (i.e. fixed wireless access (FWA) and small-cell networks) DotEcon do not believe that these markets are relevant from the point of view of determining measures to safeguard competition.

6.150 DotEcon does not agree with Imagine that MNOs have strong incentives to acquire spectrum rights of use as a barrier to entry to other parties such as Imagine. MNOs who also provide FWA may find some benefit in doing so, but these concerns have been raised before in relation to the 3.6 GHz award, and DotEcon does not believe this situation is likely to arise.

6.151 Finally, DotEcon notes that the recommended auction format (i.e. the CCA) is an 'entrant friendly' award format, providing scope for a smaller bidders with

potentially lower spectrum requirements than MNOS to fit in with the demands of the incumbents but also ensuring (through package bidding) that any spectrum portfolio acquired would be sufficient for its needs.

Consideration for the overall cap

- 6.152 DotEcon does not believe that a full competition assessment (as suggested by Eir) was or is necessary as the proposed caps are not designed to micromanage the spectrum holdings of operators or establish a particular market structure. Rather, the proposed competition caps are in place to prevent excessively asymmetric outcomes that might be harmful to downstream competition.
- 6.153 In relation to the overall cap, DotEcon recognises that its assessment of asymmetry assumed that the MNOs would acquire as much of the available spectrum rights of use between themselves as allowed by the proposed caps, and did not take sufficient account of the possibility that other bidders might win some of the spectrum.
- 6.154 On this basis, DotEcon suggests that it may be appropriate to set the overall cap at the lower end of the range proposed, to allow for the possibility that other users might have an impact on the relative post-award spectrum holdings of the MNOs.

Eir's alternative metric

- 6.155 DotEcon notes that Eir does not provide any indication of what would be considered a suitable level of asymmetry under its alternative asymmetry metric (based on the difference between the largest and smallest MNO holdings as a proportion of the largest MNO spectrum holdings).
- 6.156 DotEcon is also unclear about Eir's concerns regarding the idea that the caps do not account for the possibility that Vodafone could increase its asymmetry relative to Eir. ComReg's proposed caps would prevent the asymmetry between Eir and Vodafone from exceeding the maximum possible level of asymmetry between Eir and Three, and DotEcon does not see any particular reason why Vodafone should not be able to increase its own spectrum holdings within these bounds.

Band specific cap

- 6.157 DotEcon disagrees with Eir that an additional cap for the 2.1 GHz Band is necessary as there is a significant amount of (long-run) substitutable spectrum being made available in this award. Furthermore, unlike any other party, Eir is currently guaranteed use of 2x15 MHz in the 2.1 GHz band until at least 2027, meaning it should have time to prepare for any changes in its holdings beyond that point without any disruption to consumers.

Three's alternative approach

- 6.158 DotEcon does not agree with Three's proposal for a 2x10 MHz cap on 700 MHz spectrum because it would seem to disadvantage the other two MNOs (relative to ComReg's proposed sub-1 GHz cap), in terms of the total sub-1 GHz spectrum they could hold after the award. Three, on the other hand, would be able to achieve the same under either option, but would face less competition if its own suggestion were applied.
- 6.159 DotEcon also notes that Three's argument that ComReg's sub-1 GHz cap would provide greater incentives for Vodafone to reduce Eir to one 700 MHz block does not seem to make sense. If a bidder placed a value on denying a competitor access to a second lot, there would always be an incentive to place a bid accordingly. The prospect of paying the opportunity cost of denying a third block to a third player should not make any difference to that.
- 6.160 Further, DotEcon does not agree with Three's proposal for supra 1-GHz cap (combined with the 700 MHz cap) because it would place tighter restrictions on the total spectrum rights of use that Vodafone and Eir could acquire in the award than the overall cap range proposed by ComReg.
- 6.161 Overall, DotEcon remains of the view that a separate 70 MHz sub-1 GHz cap and overall cap (at the lower end of the range) that takes account of existing holdings remains the most suitable approach for setting measures for safeguarding competition

6.5.4 ComReg's assessment of respondent's views

- 6.162 ComReg notes the views of respondents and has carefully considered this material and other material before it, including the views of DotEcon as summarised above.
- 6.163 ComReg assesses the views of respondents under the following broad headings:
- submissions raised of a more general nature, including those of Three;
 - bands considered under proposed competition caps, including Three's requests for clarification;
 - ComReg's proposed sub-1 GHz cap, including Three's alternative proposal, and updated consideration of ComReg's proposal against various regulatory obligations and principles; and
 - ComReg's proposed overall cap, including Eir's and Imagine's proposals;

Submissions raised of a more general nature

6.164 In relation to **point (i)** raised by Three (regarding legal basis), ComReg outlines its response below:

- first, ComReg observes that it proposed to apply the same sub-1GHz and overall caps on all potential bidders (e.g. Three and any other bidder could hold a maximum of 70 MHz of sub-1 GHz spectrum). Therefore, ComReg does not agree that the proposed caps are asymmetric *per se*;
- of course, the proposed caps would affect potential bidders differently because of their respective pre-existing spectrum holdings (e.g. 800 MHz and 900 MHz holdings in respect of the proposed sub-1 GHz Cap);
- the relevant question, therefore, is whether, as a matter of principle, taking into account existing (relevant) spectrum holdings in the context of a proposed competition cap in a spectrum award is without legal basis;
- in that regard, ComReg refers to its objectives etc. in relation to competition generally and to Regulation 9(11) of the Authorisation Regulations in particular which provides:

“The Regulator shall ensure that radio frequencies are efficiently and effectively used having regard to section 12(2)(a) of the Act of 2002 and Regulations 16(1) and 17(1) of the Framework Regulations. The Regulator shall ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies. For this purpose, ComReg may take appropriate measures such as mandating the sale or lease of rights of use of radio frequencies.” (emphasis added)

- in light of this provision, ComReg observes that it is, in fact, obliged to consider whether undertakings potentially obtaining additional spectrum rights (such as in the Proposed Award) would distort competition. Clearly, it is difficult to assess the potential effects of an accumulation of spectrum rights without having any regard to the existing spectrum holdings of undertakings;
- given this, it is entirely appropriate that ComReg, among other things:
 - examined whether any existing spectrum holdings were relevant to the rights proposed to be awarded in the context of potentially affecting downstream competition;
 - considered the position of the undertaking with the highest level of existing, relevant spectrum holdings (i.e. Three); and

- considered the existing and potential level of asymmetry between it and other relevant undertakings and, in particular, other MNOs including the MNO with the lowest spectrum holdings, to assess potential distortions to competition;
- furthermore, if ComReg considers that any accumulation would likely distort competition, then it is also obliged under Regulation 9(11) to take appropriate measures to prevent same. In that regard, ComReg would highlight Article 5 of the RSPD Decision which identifies, in the context of Member States' obligations to promote effective competition and avoid distortions of competition in the internal market for ECS, various measures that can be taken by Member States, including in particular:
 - limiting the amount of spectrum for which rights of use are granted to any undertaking; and
 - refusing to grant new rights of use of spectrum or to allow new spectrum uses in certain bands, or attaching conditions to the grant of new rights of use of spectrum or to the authorisation of new spectrum uses, in order to avoid the distortion of competition by any assignment, transfer or accumulation of rights of use (emphasis added);
 - in light of the above, ComReg's spectrum cap proposals in Document 19/59R clearly has legal basis in principle.

6.165 In relation to point **(ii)** raised by Three (regarding discrimination), ComReg outlines its response as follows:

- the proposed caps would affect potential bidders differently based on their respective existing spectrum holdings;
- the relevant question is whether different treatment of potential bidders under the proposed caps on the basis of their respective existing spectrum holdings would be objectively justified and appropriate to the subject matter and purpose of the measure (including having regard to the principles and objectives of the field);
- Regulation 9(11) obliges ComReg to consider whether any accumulation of spectrum rights would distort competition - which, for obvious reasons, necessarily entails consideration of existing spectrum rights; and
- existing spectrum holdings must, by definition, be a permissible basis by which to justify different treatment of undertakings where they would be likely to contribute to an offending accumulation under Regulation 9(11).

6.166 In relation to **point (iii)**, ComReg observes that Three appears to have ignored the considerations set out in Document 19/59R (and the DotEcon Report accompanying same) informing ComReg's spectrum competition cap proposals. For instance:

- in Section 7.7.4 of Document 19/59R, ComReg considered that there did not appear to be any strong basis for the view that existing spectrum asymmetry is harming competition;
- in Section 7.7.1 of Document 19/59R, ComReg noted that the main purpose of a competition cap is to ensure that the distribution of spectrum rights in an award is determined by competition among bidders, subject to ensuring that extreme asymmetric outcomes which could harm downstream competition do not emerge from the award¹²⁹;
- ComReg described and considered the potential implications of setting caps (both sub-1 GHz and overall cap) at a variety of different levels, including potential "worst case outcomes"¹³⁰ (see Table 10 and Table 11 Document 19/59);
- in relation to the sub 1GHz cap, ComReg observed that:
 - a cap above 70 MHz, could result in an outcome where two MNOs obtained all of the available 700 Duplex MHz rights of use and, further, Three could have double the 700 MHz rights of use of Eir;
 - such an outcome would be unlikely to promote or safeguard competition as it could provide Three with significant advantages over Eir (see further below); and
 - alternatively, a cap of 70 MHz would ensure a minimum of three winners with at least 2x5 MHz each thereby avoiding the distortions to competition identified above.
- in relation to the proposed overall cap, ComReg observed that a cap up to 420 MHz would be double the absolute asymmetry prior to the award but that asymmetry as a percentage of total holdings available would be similar to the time of the Merger. A cap beyond these levels

¹²⁹ Therefore, ComReg's concerns do not arise from existing asymmetries but from potential (extreme) asymmetries across all relevant available spectrum that may arise from the Proposed Award so as to distort competition.

¹³⁰ In their original report, DotEcon defined a measure of asymmetry between a number of parties as the difference between the greatest amount of spectrum held by any given party, and the minimum held by any party. With this definition, the asymmetry metric for the MNOs' current spectrum holdings is the difference between Three's holdings and Eir's holdings:

would be in excess of the levels previously accepted by the European Commission and would risk extreme asymmetries.

6.167 ComReg further observes that Three does not appear to have meaningfully addressed these considerations in its response to Document 19/59R.

6.168 In relation to **point (iv)** raised by Three (proportionality), ComReg observes that Three's claim ignores the fact that both DotEcon and ComReg described and considered the potential implications of setting caps (both sub-1 GHz and overall cap) at a variety of different levels, including the potential implications of a more relaxed sub-1 GHz cap of above 70 MHz. For the avoidance of doubt, ComReg considers the proportionality of its proposals, including in light of responses received to its proposals, later in this section.

6.169 In relation to **point (v)** raised by Three (regarding ComReg's previous practice vis-à-vis existing spectrum holdings), ComReg recalls that it has previously considered whether existing spectrum holdings were appropriate in determining relevant competition caps. For example:

- in Section 3.3.2 of Consultation 10/105¹³¹, ComReg addressed the issue of spectrum competition caps in the context of the 2012 MBSA. ComReg expressed the view that existing spectrum holdings in the 2.1 GHz band (where each of the four incumbent MNOs had 2 x 15 MHz of paired 2.1GHz spectrum at that time) were unlikely to be large enough to materially affect the long-run structure of the market. Accordingly, ComReg proposed that existing spectrum assignments in the 2.1 GHz band would not count towards the proposed spectrum caps in a multi-band award;
- existing spectrum holdings in Time Slice 1 for MBSA 2012 counted towards a bidder's spectrum cap for that time period regardless of whether this spectrum was liberalised within the award process¹³²;
- in Section 4.1.2 of Document 13/88¹³³, ComReg addressed the issue of spectrum competition caps in the context of the 1800 MHz Award and considered that a competition cap was unnecessary in that instance because the award of 1800 MHz spectrum would be unlikely to lead to an extreme outcome which could harm competition and consumer welfare; and
- in Section 5.4 of Document 15/70, ComReg addressed the issue of

¹³¹ See also Annex 5 of ComReg Document 12/25A for a full discussion of ComReg's position on competition caps in the MBSA process.

¹³² Multi-band Spectrum Release Information Memorandum (Document 12/52) – Section 4.2

¹³³ 13/88 – Consultation and Draft Decision on the release of 1800 MHz spectrum rights of use.

spectrum competition caps in the context of the 3.6 GHz Band Award. ComReg was of the view that there were material differences between the technical characteristics of the 3.6 GHz band and the existing assigned mobile spectrum bands (i.e. 800 MHz, 900 MHz, 1800 MHz, and 2.1 GHz), at that time, such that it was unlikely to be substitutable for existing holdings. Given these differences, ComReg considered that existing spectrum holdings should not count towards any competition cap in this particular award process.

6.170 In relation to **point (vi)** raised by Three, ComReg recalls that it specifically noted that any spectrum assigned in the 3.6 GHz Band Award could be taken into account in future awards including the assignment of 2.3 GHz and 2.6 GHz bands. For example:

- in paragraph 5.72 of Document 15/70, ComReg stated:

“ComReg observes that, for certain uses, the 3.6 GHz band may, over time, become more substitutable for other “mobile bands” - the 2.3 GHz and/or 2.6 GHz bands in particular.

Accordingly, ComReg notes that 3.6 GHz holdings obtained under this award process may be taken into account for a competition cap of the award of sufficiently substitutable spectrum bands (for example, 2.3 and/or 2.6 GHz) and ComReg welcomes views from interested parties on this issue.¹³⁴ (emphasis added); and

- In Document 15/140, ComReg stated:

“ComReg received no views, with regard to the extent to which other spectrum bands may become more substitutable with the 3.6 GHz band and may be worthy of consideration in a competition cap in the future. ComReg therefore reserves its position but reiterates that any 3.6 GHz holdings obtained under this award may be taken into account for a competition cap for the award of sufficiently substitutable spectrum bands in the future.”¹³⁵ (emphasis added)

6.171 In relation to **point (vii)** (regarding whether a RIA is required under Ministerial Policy Direction No. 6¹³⁶), ComReg outlines its response as follows:

¹³⁴ Document 15/70, para 5.72

¹³⁵ Document 15/140, para 5.64.

¹³⁶ This direction states:

“ComReg, before deciding to impose regulatory obligations on undertakings in the market for

- first, ComReg's spectrum cap proposals are not regulatory obligations *per se* (e.g. in contrast to a potential licence condition);
- ComReg observes that in similar forward-looking competition analysis (e.g. spectrum transfer/lease, proposed merger), ComReg (and competition authorities) do not carry out a RIA; and
- in any event, the substance of ComReg's (and DotEcon's) analysis informing its spectrum cap proposals (including in the present documents), clearly considers its own and alternative proposals from a competition perspective - and, implicitly, from consumers' perspective - and the impact on industry stakeholders.

6.172 In relation to Eir's claim that ComReg has not conducted a proper assessment of competition in the mobile market, ComReg outlines its response below:

- first, the proposed competition caps are to prevent extreme asymmetric outcomes (i.e. excessive accumulations) that would likely distort downstream competition;
- in particular, they are not designed to micromanage the spectrum holdings of operators or establish a particular market structure, and as such the proposed range for the overall cap is designed to allow reasonable flexibility for the market to establish the distribution of spectrum;
- further, ComReg refers to its competition (and by implication, consumer) considerations in Document 19/59R and as updated and refined in this document; and
- ComReg notes that its proposed competition caps would only apply for the duration of the proposed auction and would not apply to the market following the **assignment** of the radio spectrum. Operators would, subject to the licences and their conditions, be free to trade, lease and combine rights of use of spectrum following the auction to the extent that such rights of use of spectrum are designated as being tradable or leasable and in line with competition law and the legal framework for electronic communications in Ireland.

ECS or for the purposes of the management and use of the radio frequency spectrum or for the purposes of the regulation of the postal sector, shall conduct a RIA in accordance with European and International best practice and otherwise in accordance with measures that may be adopted under the Government's Better Regulation programme."

Bands considered under proposed competition caps, including Three's requests for clarification

6.173 In relation to **point (viii)** raised by Three, ComReg outlines its response below:

- ComReg identified which spectrum holdings it considered should be counted in its proposed caps in Section 7.7.6 of Document 19/59R;
- in particular, ComReg set out its preliminary view that any caps applied should take into account the existing holdings of all operators assigned rights of use in the 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 3.6 GHz Bands, since these rights (together with the spectrum holdings arising from the outcome of the Proposed Award) would play a part in the post-award competitive landscape. For example:
 - the current sub-1GHz bands (700 MHz, 800 MHz and 900 MHz) are likely to be sufficiently close substitutes over the long-run for providing cost-efficient coverage; and
 - the 2.1 GHz, 2.3 GHz and 2.6 GHz bands can all be used to provide WBB services and have existing ecosystems with compatible devices. They are also likely to be sufficiently close substitutes for one another and to a greater or lesser extent, the 1800 MHz and 3.6 GHz bands.

6.174 In relation to **point (ix)** raised by Three, ComReg notes that Document 19/59R (footnote 430) clarified that the relevant 3.6 GHz holdings for the purpose of the proposed overall cap would be the maximum amount assigned to an operator in any given region. In effect, a bidder's cap would take into account the maximum spectrum any such bidder could get in any part of the country.¹³⁷

6.175 In relation to **point (x)** raised by Three, while Eir is currently assigned 2.3 GHz rights of use for its RurTel network (as described in Document 19/59R and elsewhere in this document), ComReg observes that these rights are for point-to-multipoint links used to provide fixed, voice-only USO services and at a small number of locations in the Donegal, Galway and Kerry regions. Given this, and that Eir is currently migrating customers off its RurTel network, there is no reason to believe that Eir's existing 2.3 GHz assignments would appreciably impact downstream competition for WBB.

6.176 In light of Three's general request for clarity, ComReg would also clarify that Three's existing 5 MHz block of 2.1 GHz TDD spectrum would also not be counted because:

¹³⁷ Document 19/59R, footnote 430.

- the 2.1 GHz unpaired band is harmonised at ECC level for DA2GC rather than WBB (and consequently has been identified by ComReg as unsuitable for this proposed award); and
- accordingly, there is no reason to believe that this right of use would appreciably impact downstream competition for WBB.

6.177 In relation to **point (xi)** raised by Three, ComReg outlines its response as follows:

- the proposed commencement date for new 2.1 GHz rights of use is October 2022 (on the basis of its 2.1 GHz interim licensing proposal);
- Three's and Vodafone's 2.1 GHz licences would have expired at that point and therefore would not be considered under the cap which only considers existing holdings beyond that date;
- Eir's existing 2.1 GHz rights expire in March 2027 – the proposed end point of Time Slice 1. Eir's existing 2.1 GHz spectrum rights in this period would count towards its overall competition cap for that time period, regardless of whether this spectrum is liberalised (but noting ComReg's proposals for early liberalisation);
- current 800 MHz, 900 MHz and 1800 MHz rights expire in 2030, and would therefore coexist with new 700 MHz rights for approximately 10 years, before being reassigned. ComReg considers that distortions to competition could materialise during this lengthy period in the event of an excessive accumulation of sub-1 GHz rights as a result of the Proposed Award; and
- similarly, current 3.6 GHz band rights expire in 2032 and would coexist with new 2.1 GHz rights for 10 years and all other rights proposed to be awarded for 12 years. Again, ComReg considers that distortions to competition could materialise during these lengthy periods in the event of an excessive accumulation of spectrum rights as a result of the Proposed Award.

ComReg's proposed sub-1 GHz cap

6.178 ComReg firstly notes that Vodafone and Eir expressed support for the proposed sub-1 GHz cap of 70 MHz which would take into account existing spectrum holdings in the 800 MHz and 900 MHz bands.

6.179 In relation to Three's stated concerns, ComReg outlines its response as follows:

- whether existing holdings in the 800 MHz and 900 MHz bands should be

counted in the sub-1 GHz cap;

- further discussion on the potential distortions to competition which ComReg is seeking to prevent via the proposed sub-1 GHz cap;
- Three's concerns as summarised in **point (xiv)**, including pricing asymmetries and claimed "perverse outcomes"; and
- Three's alternative proposal for the 700 MHz band; and
- updated consideration of ComReg's proposal against various regulatory obligations and principles.

Existing spectrum holdings in the 800 MHz and 900 MHz

6.180 In relation to Three's view that the 900 MHz Band is not a direct substitute for 700 MHz Duplex, ComReg agrees with DotEcon that it is the long term use of the spectrum (particularly in light of the revised proposed licence duration) that is most relevant and all sub-1 GHz bands are likely to be long-run substitutes for providing coverage. In that regard, ComReg notes that all sub-1 GHz spectrum share propagation attributes that make the bands largely substitutable from a network design perspective. The 700 MHz, 800 MHz and 900 MHz bands can all be used to deliver national coverage and support the future strong growth in demand for mobile broadband services for 4G and 5G. For example:

- 700 MHz, 800 MHz and 900 MHz are harmonised frequency bands with technological possibilities from their combined use¹³⁸. In particular, ComReg recalls the advice from Oxxera that three band carrier aggregation (i.e. 700 MHz, 800 MHz and 900 MHz) can result in significant improvements in coverage and a considerable impact on the estimated network costs;
- as noted by the RSPG, the 700 MHz, 800MHz and 900MHz bands are already potentially available for 5G. The harmonised technical conditions for those bands are based on the concept of block edge masks, in order to facilitate a technologically neutral approach and least restrictive conditions, which allows for the use of any technology that complies with the block edge mask.¹³⁹ In this regard, the 900 MHz Band is a relevant EU-harmonised frequency bands for next-generation terrestrial wireless

¹³⁸ <https://ec.europa.eu/digital-single-market/en/news/commission-sets-out-technical-conditions-allocate-more-radio-frequencies-mobile-internet>

¹³⁹ RSPG also refers to this possibility in its Second Opinion noting that "In due course, the mobile operators could perform transition of lower frequency mobile spectrum (800, 900, 1800, 2100, 2600 MHz) to 5G, but some studies suggest that 4G LTE and its evolutions will continue to develop in parallel to 5G deployments (as 3G continues to be used today in parallel to 4G)"

systems¹⁴⁰;

- following an EC mandate, CEPT is currently investigating the technical compatibility of new 5G technologies with GSM, notably in the 900 MHz band¹⁴¹; and
- in the context of 5G, it is widely accepted that 5G deployments will focus, in the short term, on enhanced mobile broadband (i.e. improvements in network performance, including by way of three-band carrier aggregation of rights in the 700 MHz, 800 MHz and 900 MHz bands).¹⁴²

6.181 In addition, ComReg observes that consideration of existing spectrum holdings in an award of 700 MHz rights has been employed in other jurisdictions. For example:

- the Dutch 700 MHz Award applied caps to each individual operator following consideration of existing holdings¹⁴³;
- the UK 700 MHz award require applicants to specify their existing spectrum holdings in their application, as this information would be required for the implementation of the overall spectrum cap¹⁴⁴¹⁴⁵; and
- the Austrian 700 MHz award applies caps to each individual operator following consideration of existing holdings.¹⁴⁶

6.182 Indeed, ComReg observes that Three's position on this particular issue (i.e. whether or not existing sub-1 GHz spectrum holdings should be taken into account in an award of 700 MHz rights) stands in contrast to Three UK's submission of 12 March 2019 to Ofcom concerning the latter's proposed award of the 700 MHz and 3.6 GHz- 3.8GHz spectrum bands.¹⁴⁷ Among other things,

¹⁴⁰ <https://www.ecodocdb.dk/download/06b2620f-202e/CEPTRep072.pdf> p33

¹⁴¹ Mandate to CEPT to review the harmonised technical conditions for certain EU-harmonised frequency bands and to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems.

<https://ec.europa.eu/digital-single-market/en/news/radio-spectrum-ceptmandates-0>

¹⁴² See, for example:

- Oxera report entitled "Future mobile connectivity in Ireland", November 2018; and
- Ofcom consultation entitled "Award of the 700 MHz and 3.6-3.8G Hz spectrum bands", 18 December 2018.

¹⁴³ <https://zoek.officielebekendmakingen.nl/blg-894607.pdf>

¹⁴⁴ https://www.ofcom.org.uk/data/assets/pdf_file/0028/172648/revised-proposal-auction-design.pdf

¹⁴⁵ A position which Three supports.

https://www.ofcom.org.uk/data/assets/pdf_file/0024/143493/three.pdf

¹⁴⁶ <https://www.cullen-international.com/product/documents/FLSPAT20190001>

¹⁴⁷ https://www.ofcom.org.uk/data/assets/pdf_file/0024/143493/three.pdf

Three UK submitted that¹⁴⁸:

“Ofcom should address the risk of further concentration of sub-1 GHz spectrum in the hands of Vodafone and O2 by the imposition of an 80 MHz (37%) sub-1 GHz cap, in addition to the overall cap.

The proposed cap would avoid extreme asymmetry in sub-1 GHz spectrum, by constraining Vodafone and O2 to acquire a maximum of 2x10 MHz of 700 MHz FDD and 5 MHz of 700 MHz SDL spectrum. This would preclude Vodafone and O2 from bidding strategically, and leave a minimum of 2x10MHz FDD and 1x10MHz of 700MHz SDL for Three and BT/EE to expand their low frequency holdings.

As we note in section 4.7, the risks of imposing a sub-1GHz cap are asymmetric – with significant upside for consumers in terms of ensuring continued effective competition in mobile services and limited if any loss in efficiency in terms of spectrum allocation.” (emphasis added)

6.183 In light of the above, ComReg remains of the view that existing spectrum holdings in the 800 MHz and 900 MHz bands should be counted towards the proposed sub-1 GHz cap.

Potential distortions to competition

6.184 In relation to Three’s view that ComReg has not identified any ‘extreme asymmetry’ and that there is no existing asymmetry that needs to be corrected, ComReg notes that while it is of the view that the existing spectrum asymmetry does not appear to be harming competition, it is not of the view that the promotion of competition would be best served by artificially retaining that asymmetry in the future.

Competitive effects

6.185 In considering the potential competitive effects arising from an extreme asymmetry, ComReg considers whether there would be an increased likelihood that smaller MNOs (e.g. Eir) or potential entrants would be foreclosed from expanding capacity, deploying alternative technologies, or entering the market, and also whether such an operators costs would be increased to the extent that they would be unable to effectively compete on a comparable basis.

6.186 In that regard, ComReg would be primarily concerned with a situation where the two larger MNOs could bid up to a sub-1 GHz cap in order to make the smallest MNO (i.e. Eir) a more marginal player by denying it 700 MHz rights of use and

¹⁴⁸ Ibid, page 33.

distorting competition in downstream markets.¹⁴⁹ This would have the largest impact on the smallest operator as it has less scope to mitigate the absence of 700 MHz rights of use because of its smaller existing spectrum holdings.

6.187 ComReg further considers this to be a particularly relevant concern in the case of a three MNO mobile market and where there are no alternative sub-1 GHz bands are likely to become available in the next decade that could provide near-term 5G services over wide areas.¹⁵⁰ Such a result (for the reasons stated below) could result in Eir becoming a more marginal player by only providing high speed services (e.g. 30Mbit/s) in urban areas and a basic service in more rural areas. In effect, competition could be distorted as the smallest MNO would be unable to provide a comparable service across a wide area which is particularly important in Ireland given the demographic characteristics outlined in the Oxera Report.¹⁵¹

6.188 ComReg notes that in Sweden, Three recently highlighted the risk of smaller operators not being assigned 700 MHz rights of use. In that matter, the fourth Swedish MNO, Hi3G (Three Sweden), did not win any 700 MHz spectrum and stated that it would appeal the 700 MHz auction results, accusing the NRA of poor regard for competition.¹⁵² In particular, Three Sweden stated that “*The design has enabled the strongest players to acquire the valuable part of the 700 MHz Duplex, which further distorts competition in the mobile market, where the largest players are given a very strong position*”¹⁵³. As mentioned above, ComReg considers such concerns to be particularly heightened in a three operator market and where alternative rights of use are unlikely to become available over the next decade.

6.189 In that regard, LS Telecom has previously highlighted the particular importance of the 700 MHz for mobile services¹⁵⁴:

- the use of the 700 MHz Duplex is important in order to provide for the timely and efficient rollout of 5G in line with the 5G Action Plan; and
- the use of the 700 MHz Duplex is important in order to allow operators

¹⁴⁹ ComReg also notes that this is similar to the concerns raised by Three's in the UK where it observed that a sub 1 GHz cap should be used to prevent “*Vodafone and O2 from bidding strategically*”. ComReg addresses concerns in relation to the scenario of Three not being assigned any rights of use in below. However, ComReg notes that Eir and Vodafone winning up to the cap would not be effective in making Three a marginal player given its large existing holdings and position in the market.

¹⁵⁰ LS Telecom Report, Document 19/59e, p65.

¹⁵¹ See Section 2.2 – Document 18/103c

¹⁵² In the recent Swedish 700 MHz award, 2 x 20 MHz was made available instead of the full 2 x 30 MHz. The remaining 2 x 10 MHz block is currently reserved for DTT and its future use will be decided separately.

¹⁵³ https://www.tre.se/privat/varfor-3/ovrigt/om-3/kontakt/press/#/latest_news/page/2?_hosted_newsroom_id=3398

¹⁵⁴ LS Telecom Report – Document 19/59e, Section 4.4.

to provide higher speed services in rural areas and along major transport routes

6.190 More specifically, ComReg observes that 700 MHz Duplex spectrum is particularly important in the delivery of connectivity across the State because:

- 700 MHz rights will allow an MNO to avail of three-band Carrier Aggregation (i.e. of its rights in the 700 MHz, 800 MHz, and 900 MHz bands), being a key technology that will reduce the cost of high-speed connectivity (i.e. 30Mbit/s). In particular, this would allow an MNO to upgrade existing sites to provide a 30Mbit/s service at substantially lower costs relative to building new sites to provide same service;
- three-band Carrier Aggregation also extends the indicative range of a macrosite in rural terrain for higher speeds (i.e. 30/50 Mbit/s). LS Telcom estimates that 700 MHz provides a 65% coverage gain for speeds of 30 Mbit/s:
 - An operator using carrier aggregation with 10 MHz in each of the 700, 800 and 900 MHz bands would be able to achieve 30 Mbits/s of capacity at ranges of around 4.5 km from a cell-site;
 - An operator using carrier aggregation with 10 MHz in each of the 800 and 900 MHz bands would be able to achieve 30 Mbits/s of capacity at ranges of up to around 3.5 km from a cell-site.

6.191 These important benefits would not be available to Eir absent obtaining 700 MHz rights. Alternatively, Eir could use carrier aggregation using the 1800 MHz Band. However, the ability to achieve this is limited by a number of factors, including:

- Three already has twice as much 1800 MHz rights of use as Eir (i.e. 2x15 MHz (Eir) and 2x30 MHz (Three));
- Vodafone and Three have significantly more 1800 MHz sites than Eir i.e. Eir (504), Vodafone (857) and Three (1,276); and
- the coverage gains referred to above would be less than under 700 MHz and additional sites would also be required in order to effectively replicate.

6.192 More generally, coverage expansion could be achieved through other means, such as new site deployment but this would require significantly higher costs. In effect, Eir would be limited to providing a lower quality service, or to maintain comparable services, they would need to increase the number of sites

deployed, requiring higher Capex and Opex. These higher costs will in turn affect their ability to compete on price with other operators.

6.193 In that regard, ComReg notes that the nature of its competition concerns in relation to potential extreme asymmetries in sub-1 GHz spectrum holdings also appear to be shared by Three UK. For example, Three UK submitted the following:

- *“There are two concerns (not one as Ofcom claims) that arise if neither BT/EE nor Three win 700MHz spectrum – capacity in harder to serve areas and the ability to rollout a nationwide 5G network.”¹⁵⁵¹⁵⁶*
- *“a scenario in which neither Three nor BT/EE win any 700MHz will lead to a substantial lessening of competition in retail markets”¹⁵⁷*
- *“In relation to 700MHz FDD spectrum Vodafone and O2 would be limited to a maximum of 2x10MHz each, consistent with the sub-1GHz cap Ofcom applied in the 4G auction and with precluding the ability of Vodafone and O2 to bid strategically. This would leave a minimum of 2x10MHz FDD and 1x10MHz of 700MHz SDL for Three and BT/EE to expand their low frequency holdings.”¹⁵⁸*
- *“proposed cap [80 MHz] ¹⁵⁹ would avoid extreme asymmetry in sub-1GHz spectrum, by constraining Vodafone and O2 to acquire a maximum of 2x10MHz of 700MHz FDD and 5MHz of 700MHz SDL spectrum. This would preclude Vodafone and O2 from bidding strategically, and leave a minimum of 2x10MHz FDD and 1x10MHz of 700MHz SDL for Three and BT/EE to expand their low frequency holdings.”*
- *“Adding sites while theoretically possible will not be a commercially feasible substitute for additional 700MHz”¹⁶⁰*
- *“The alternatives to low frequency spectrum such as site densification or other technological solutions proposed by Ofcom are either not*

¹⁵⁵ Three’s response to Ofcom’s consultation on the Award of the 700 MHz and 3.6-3.8 GHz spectrum bands - p32

¹⁵⁶ ComReg notes that these concerns align with the two major benefits of the 700 MHz Duplex outlined by LS Telecom.

¹⁵⁷ Three’s response to Ofcom’s consultation on the Award of the 700 MHz and 3.6-3.8 GHz spectrum bands - p33

¹⁵⁸ Ibid - p44

¹⁵⁹ The Ofcom Award includes 20 MHz sub 1 GHz SDL which is not being assigned in the Proposed Award meaning a cap of 80 MHz is required to have the same

¹⁶⁰ Three’s response to Ofcom’s consultation on the Award of the 700 MHz and 3.6-3.8 GHz spectrum bands - p37.

commercially practicable or will only have a marginal impact¹⁶¹
(emphasis added).

6.194 Finally, these views from the perspective of the smallest MNO in the UK were made in the context of a four operator market. In that regard, ComReg notes that these concerns are all the more pertinent in a three operator market and the imposition of a 70 MHz sub 1 GHz cap is necessary to prevent the excessive concentration of sub-1GHz spectrum and risks of distortions to competition.

6.195 In light of the above additional material, ComReg considers that it has addressed Three's various claims regarding lack of reasoning/justification etc including Three's concerns as summarised in **point (xiii)** above.

Three's concerns as summarised in point (xiv), including pricing asymmetries etc

6.196 In relation to **point (xiv)(a)** raised by Three (i.e. not winning any 700 MHz spectrum), ComReg observes that its arguments are premised on the notion of excluding other sub-1 GHz spectrum holdings which, for the reasons outlined above, is not persuasive. Therefore, when viewed in the context of total sub-1 GHz holdings, ComReg considers the following points from DotEcon's assessment of Three's claim particularly convincing:

- If there is no interest for the 700 MHz lots other than from the MNOs, then all three MNOs would be faced with the prospect of ending the auction with five, six or seven sub-1 GHz lots; and
- If there is interest from at least one additional bidder, then Three is arguably in a more favourable position than Vodafone and Eir due to its greater existing holdings; in that case it would be guaranteed five sub-1 GHz lots at the end of the auction, while the other two would only be guaranteed four.

6.197 In any event, ComReg considers such a situation as unlikely to occur as it would require Eir and Vodafone to have a marginal valuation for a third lot that would be greater than Three's valuation of just one lot (noting that such a situation would not result in Three becoming a marginal player given its existing spectrum holdings).

6.198 In relation to Three's concerns regarding asymmetric pricing arising from the combination of the proposed sub-1 GHz cap and the proposed CCA format, ComReg firstly refers to the discussion in paragraphs 6.47 - 6.53 above (regarding asymmetric pricing) and its assessment of Three's **point (ii)** regarding discrimination. In light of this context, ComReg considers the

¹⁶¹ Ibid - p32.

following points from DotEcon's assessment of Three's claims particularly convincing:

- when MNOs are viewed in the context of total sub-1 GHz holdings, Three is clearly not starting from the same position as Vodafone and Eir (because of its additional 2x5 MHz of 900 MHz spectrum); in effect, Three is not bidding for the same thing as the other MNOs and may also face a different level of competition from its rivals due to differing requirements for incremental spectrum across bidders¹⁶²;
- given this, Three bidding for two 700 MHz lots in the award is the equivalent of one of the other MNOs bidding for three lots (as in both cases it would take the bidder to seven sub-1 GHz blocks in total). So Three winning a second 700 MHz lot (and a seventh sub-1 GHz block) can be essentially viewed as the same as Vodafone/Eir winning a third 700 MHz lot, and it is not unreasonable that Three should pay the opportunity cost associated with denying another MNO a seventh sub-1 GHz block;
- conversely, if Vodafone were to win a third 700 MHz lot, the opportunity cost it would be required to pay (absent other bidders) would be set by the implied value of a seventh sub-1 GHz block to Three or Eir (i.e. based on Three's bid for two 700 MHz lots or Eir's bid for three 700 MHz lots);
- when taken in the context of overall sub-1 GHz holdings, any asymmetry in pricing which results is not a result of discriminatory treatment of Three. Indeed Three is clearly not in a comparable position with other MNOs in terms of sub-1 GHz holdings. Instead, MNOs (or other operators) with less spectrum than Three to start with will potentially have a greater appetite for spectrum (in order to catch up with Three and/or to simply meet a growing need for spectrum), in which case Three will naturally face more competitive pressure and higher prices if it wants to increase its own holdings.

6.199 In relation to Three's concerns relating to the proposed sub-1 GHz cap providing greater incentives for Vodafone to reduce Eir to one 700 MHz block (as it would not have to pay the opportunity cost of denying a third block to Three), ComReg agrees with DotEcon's assessment that this argument is somewhat speculative and does not seem to make sense. In particular, DotEcon observes:

- in the hypothetical situation that a bidder placed a value on denying a competitor access to a second lot, there would always be an incentive to

¹⁶² Therefore valuations (and prices) are likely to vary across bidders, and there is no particular reason to expect or require that any award process should lead to uniform pricing.

place a bid accordingly; and

- the prospect of paying the opportunity cost of denying a third block to a third player should not make any difference to that. For example, if the bidder places a value of €100 on restricting a rival to only one block rather than two, then if rational, it would still choose to do so regardless of whether that would cost €1 or €99. If the cost were to be greater than €100 then it would not be worth the investment and presumably the bidder would not have submitted a bid that would result in a price that it considered too high.

Three's alternative 700 MHz competition cap proposal

6.200 ComReg notes Three's alternative 700 MHz proposal whereby:

- The caps should be “*symmetric*” and limited to the bands available in the auction; and
- “*the most appropriate cap is 2x10 MHz per operator. If ComReg prefers instead to have a 2x15 MHz cap, then it must not use a CCA to allocate this band, as format [sic] is discriminatory given predictable asymmetries between MNOs*”.

6.201 First, for the reasons outlined above, ComReg remains of the view that it is appropriate to take into account existing sub-1 GHz holdings in its award of 700 MHz rights of use.¹⁶³

6.202 Second, and by way of background, ComReg observes that Regulation 9(11) not only obliges ComReg to prevent accumulations that would distort competition, it also, by implication, obliges ComReg to permit accumulations that would not distort competition *ceteris parabis*. See, for example, ComReg's spectrum transfer/lease procedures.¹⁶⁴ Therefore, and simply put, Three's proposal is not, in ComReg's view, plausible because it would restrict Vodafone's, Eir's, Imagine's, Airspan's and any potential entrant/s' ability to acquire additional sub-1 GHz (and supra-1-GHz GHz) spectrum rights in circumstances where such respective accumulations are not considered, under ComReg's proposed spectrum caps, to be likely to distort competition under Regulation 9(11).

6.203 Third, and without prejudice to the above, ComReg observes that under Three's

¹⁶³ Including Three UK's support for such an approach in the UK 700 MHz and 3.6 GHz-3.6 GHz award.

¹⁶⁴ ComReg also observes that the notion of only preventing/addressing something that would be anti-competitive is, unsurprisingly, also a fundamental concept in competition law. E.g. merger control, assessment of potentially anti-competitive agreements and potential abuse of dominance.

700 MHz proposal it would only be able to obtain 2 lots of 700 MHz spectrum. i.e. the same as under ComReg's proposed sub-1 GHz cap. However, Three's proposal would be more restrictive on other potential bidders compared to ComReg's proposed sub-1 GHz cap. For example:

- with a 70 MHz cap on sub-1 GHz spectrum, any (and potentially two) of the three MNOs could end the award with seven sub-1 GHz blocks, whereas under Three's proposal, only Three would have the option of acquiring a seventh sub-1 GHz block, with Vodafone and Eir able to end the auction with at most six;
- limiting any new entrant to 2x10 MHz in the 700 MHz Duplex (compared to when they would be able to obtain 2x30 MHz under ComReg's proposal) when they may reasonably require more sub-1 GHz spectrum rights to compete effectively with incumbent MNOs given incumbents' existing sub-1 GHz spectrum holdings.

6.204 ComReg also notes DotEcon's observation that Three's proposals seem in general to be to the detriment of other bidders who would be more constrained in their bidding options than under ComReg's proposals. (i.e. it would effectively maintain the current asymmetry in favour of Three going forward as only it would be in a position to obtain a seventh sub-1 GHz block and more spectrum above 1 GHz).

6.205 Further, as noted by DotEcon, ignoring previously assigned spectrum when determining appropriate competition caps would fail to take into account relevant factors affecting downstream competition and potentially be contrary to ComReg's statutory objective to promote competition. For example, if ComReg decided not to consider existing spectrum holdings (as suggested by Three), it would allow strong incumbents to create extreme asymmetries over the course of number awards even if the asymmetric outcome arising from each individual award was more modest.

6.206 Moreover, absent consideration of existing holdings, incumbents would always have the opportunity to retain that advantage indefinitely which could preserve distortions to competition in the long run. Only considering spectrum available for assignment in the Proposed Award would risk creating distortions to competition because operators compete downstream using all available rights of use rather than just spectrum available in the Proposed Award.

6.207 Alternatively, ComReg's approach allows all bidders to compete for rights of use up to the same spectrum competition cap taking account of the total amount of spectrum. As noted by DotEcon, competition in the downstream market is affected by relative total holdings of substitutable or complementary spectrum, not just the amount won in a particular award. Similarly, the assessment of

extreme asymmetries occurs on the same basis and with respect to all spectrum used to deliver services downstream rather than a subset of

6.208 Finally, ComReg refers to Figure 9 below which illustrates the difference between Three's and ComReg's proposals.

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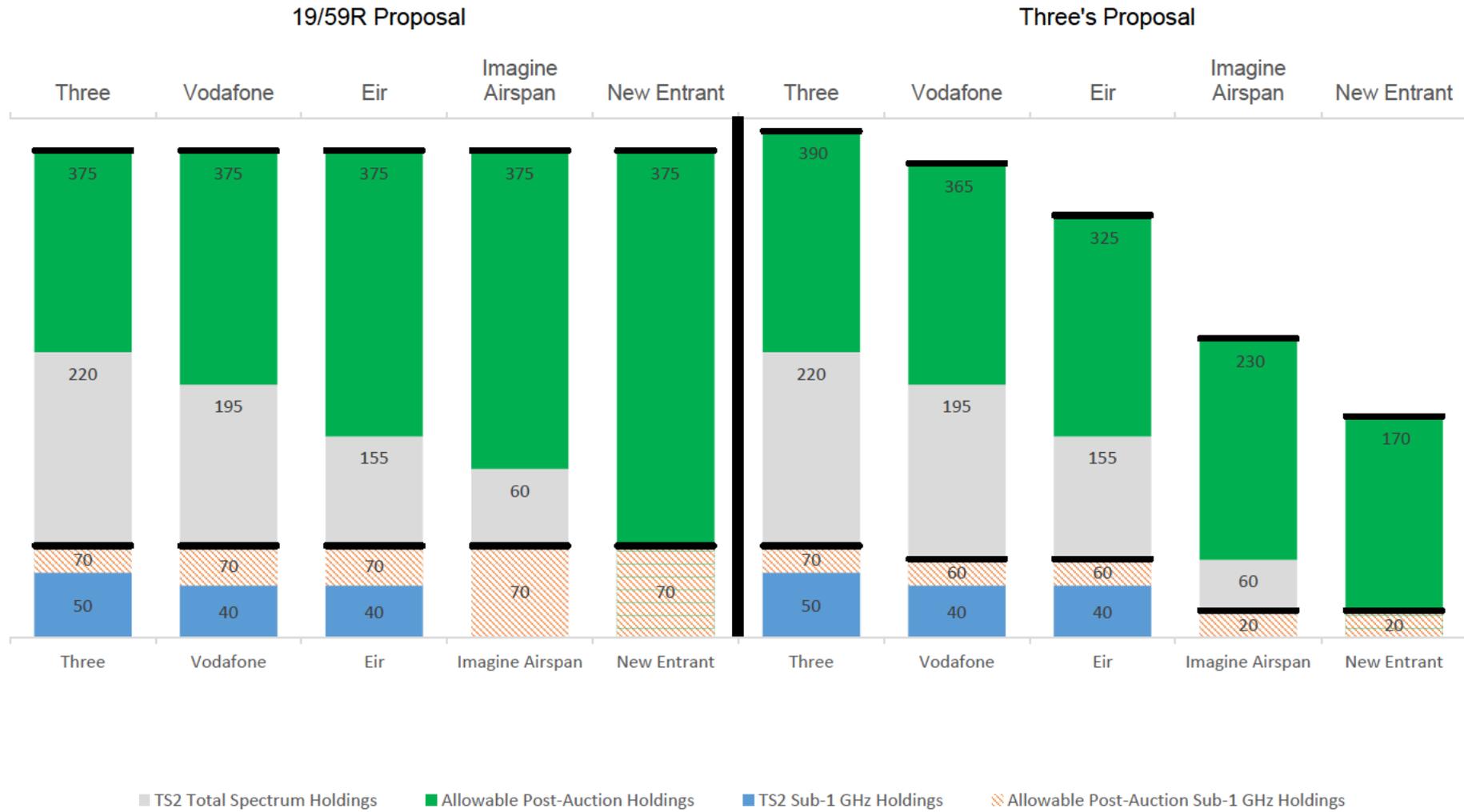


Figure 9: Competition cap proposals

Updated consideration of ComReg's proposal against various regulatory obligations and principles

6.209 First, and in relation to the principle of non-discrimination, ComReg refers its assessment of Three's **point (ii)** above.

6.210 Second, and having considered the views of Three and other interested parties, including Three's 700 MHz proposal, ComReg considers that its sub-1 GHz would be proportionate for reasons including that:

- its proposal, which would entail consideration of relevant existing sub-1 GHz spectrum holdings, and limit Three to only 2 lots of 700 MHz Duplex spectrum (i.e. 70 MHz overall), is suitable for the realisation of its obligations under Regulation 9(11) – which again necessarily entails the consideration of relevant existing spectrum holdings - and in light of the various measures identified in Article 5 of the RSPP Decision;
- in contrast, Three's proposal is not, in ComReg's view, plausible because it would restrict Vodafone's, Eir's, Imagine's, Airspan's and any potential entrant/s' ability to acquire additional sub-1 GHz spectrum rights in circumstances where such respective accumulations are not considered, under ComReg's proposed spectrum caps, to be likely to distort competition under Regulation 9(11);
- indeed, ComReg observes that Three would only be able to obtain 2 lots under both its own proposal and ComReg's proposal, but, for the reasons identified above, Three's proposal is clearly more restrictive on other bidders than ComReg's; and
- for the reasons identified earlier in this section (e.g. regarding Three's claims in relation to pricing asymmetries and "perverse outcomes"), ComReg does not believe that its proposal would impose a burden on Three that would be excessive to the objective sought.

6.211 Third, and in relation to the principle of promoting efficient investment and innovation in new and enhanced infrastructures, ComReg's sub-1 GHz proposal would be less restrictive than Three's (vis-à-vis other MNOs, existing non-MNO operators and new entrants) and therefore more likely to promote efficient investment by allowing these parties to express their potential demand for more 700 MHz spectrum rights in circumstances where such demand would not be likely to distort competition.

6.212 Fourth, in relation to the regulatory principle of promoting regulatory predictability, ComReg refers to its assessment of Three's **points (v) and (vi)** above. Furthermore, and in light of Three's claims, ComReg wishes to make

clear that any 700 MHz Duplex holdings obtained under the Proposed Award may be taken into account for a competition cap/s for the award of sufficiently substitutable spectrum bands in the future.

6.213 Fifth, in relation to Regulation 11 of the Authorisation Regulations, ComReg refers to, among other things:

- its consideration of the potential distortions to competition that could arise in both Document 19/59R and as updated and refined in this document; and
- ComReg's proposal would better meet the obligations regarding selection criteria for granting rights of use compared to Three's proposal, as Three's proposal would not comply with Regulation 9(11) and, by implication, not be objective, would be unduly discriminatory to other potential bidders (i.e. other MNOs, non-MNOs and potential new entrants) and be disproportionate.

6.214 In light of the above, and the assessment of the interaction between caps and the CCA, ComReg is of the view that it has not received any information that would reasonably require a modification to its sub-1 GHz cap proposals as set out in Document 19/59R, except to clarify that any 700 MHz Duplex holdings obtained under the Proposed Award may be taken into account for a competition cap/s for the award of sufficiently substitutable spectrum bands in the future.

ComReg's proposed overall cap

6.215 ComReg addresses the views of respondents on its proposed overall cap as follows:

- Three's concerns at **points (xvi) – (xviii)**;
- Imagine's suggested overall cap;
- Eir's suggested 2.1 GHz Band specific cap;
- Eir's claim that ComReg proposes to "support maintaining the same degree of asymmetry in the market";
- Eir's submissions regarding asymmetry with Vodafone; and
- Eir's alternative metric.

6.216 Following this, ComReg sets out further considerations on, and its proposals for, the specific level of the overall cap.

Three's concerns

6.217 In relation to Three's concerns at **points (xvi) – (xviii)**, ComReg considers that the substance of these claims have been addressed in the preceding discussion. For example:

- It could reduce competition between bidders for incremental amounts of spectrum during the award because smaller bidders would be unable to compete for additional spectrum even if would be efficient to do so.
- It would likely preserve the status-quo in terms of the relative asymmetry between bidders, precluding the possibility of an alternative outcome that may be more efficient and could better promote competition downstream.
- It would allow Three, at a minimum, to retain its 25 MHz and 55 MHz advantage over Vodafone and Eir in the supra 1 GHz Bands by winning up to the supra 1 GHz cap when an alternative asymmetry may have been more efficient and better promote competition.
- Any new entrant would also be limited to 150 MHz in the supra 1 GHz bands (other than 700 MHz) when they may reasonably require more to compete effectively.

6.218 ComReg further observes that the concerns it identified with Three's 700 MHz proposal, in particular with respect to Regulation 9(11), would also apply to Three's overall cap proposal.

Imagine's proposed overall cap

6.219 In relation to Imagines' suggestion that caps should be based on no one operator acquiring more than 25% of the total available spectrum (an overall competition cap of 290 MHz), ComReg notes DotEcon's observation that Imagines' proposal appears to effectively reserve spectrum for non-mobile bidders, which would mean at least 170 MHz would be guaranteed to non-incumbent MNO users.

6.220 By way of background, ComReg recalls that it previously addressed these concerns at paragraphs 7.237 – 7.240 of Document 19/59R where, among other things, ComReg observed that a 25% cap would be highly restrictive and result in an effective reservation for non-incumbent bidders, creating a number of risks as identified in para 7.240, including unsold lots, speculative entry and/or an inefficient assignment.

6.221 Furthermore, it is not clear to ComReg how Imagine's proposal would comply with Regulation 9(11) in circumstances where it has not identified, firstly, how accumulations by existing MNOs beyond its proposed 25% cap (i.e. beyond 290

MHz), but below ComReg's proposed overall cap, would likely distort competition. Moreover, ComReg does not consider that Imagine has made a particularly persuasive case for a reservation for non-mobile operators and/or new mobile entrants noting:

- DotEcon's observation that there does not appear to be any particular justification for an effective reservation as there is significant uncertainty over the benefits that might be gained from non-traditional and untested business models;
- the proposed overall cap would allow Dense Air and Imagine to obtain over 300 MHz of spectrum rights; and
- that non-MNO operators were successful in acquiring spectrum rights in the 3.6 GHz Award without the need for any express or implied reservation of the kind suggested by Imagine.

6.222 Without prejudice to this view, ComReg sets out additional concerns with Imagine's proposal below.

6.223 In relation to Imagine's view that a mechanism could allow for the cap to be breached in the event of unsold lots, ComReg observes that Imagine has not detailed how such an approach would work.

6.224 In addition, and noting that Imagine has not made out a strong case of competitive distortions for MNOs obtaining spectrum rights above its proposed cap, then its proposal is likely to unduly restrict downstream competition to the detriment of consumers by limiting the amount of spectrum available to the MNOs for well-established mobile services. For example,

- Three would not be permitted to participate in the Proposed Award as it has already been assigned over the 25% limit proposed by Imagine.
- Three would also have 60 MHz rights of 2.1 GHz use expiring in 2022 shortly after the Proposed Award leaving it with less spectrum rights of use in 2022 compared to now despite increased demand spectrum.
- Vodafone and Eir would be limited to 35 MHz and 75 MHz with both having 30 MHz rights of 2.1 GHz rights of use expiring in 2022 and 2027.

6.225 In light of the above, ComReg does not consider Imagine's proposal to be a viable and less restrictive option than ComReg's proposed overall cap.

Eir's 2.1 GHz Band specific cap proposal

6.226 Eir states that the purpose of its proposed 2.1 GHz Band specific cap is to prevent any subset of the three existing MNOs from acquiring all of the available 2.1 GHz spectrum, thereby denying it to one or more competitors.

6.227 However, ComReg notes that it is not clear why bidders would behave in such a way given the following:

- i. The availability of alternative substitutable spectrum
- ii. Existing licences would run for a period of time after the award;
- iii. It could prove costly given potential value differences between the bands; and
- iv. It would limit a bidder's options in other bands given a cap of 375 MHz (see ComReg's overall cap proposals below).

6.228 In relation to (i), ComReg previously discussed the substitutability of the 2.1 GHz Band with other bands in the 'Spectrum for Award' RIA and in Chapter 4.

6.229 In relation to (ii), existing licensees have significantly more flexibility to adapt to any loss of 2.1 GHz spectrum compared to 2012 as bidders have existing rights of use in other bands (i.e. 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz) so issues regarding continuity of service would appear limited, particularly for Eir which would have until 2027 to migrate from the 2.1 GHz Band. As noted by DotEcon, Eir should have time to prepare for any changes in its holdings without any disruption to consumers. More generally, all bidders would have time to migrate to other bands (if they did not acquire rights of use in the band) as such rights of use do not expire until 2022 (Vodafone & Three) and 2027 (Eir).

6.230 In relation to (iii) ComReg notes that any attempt to acquire a large amount of the 2.1 GHz Band would likely to be costly and such a strategy would make rights of use in the other bands comparatively cheaper for rivals. (i.e. by acquiring large amounts of 2.1 GHz a bidder would provide less competition in other bands) noting that the proposed minimum price of rights in the 2.1 GHz Band at the outset would be five times the 2.3 GHz Band and 2.6 GHz Band.

6.231 In relation to (iv), given the likely requirement MNO's have for spectrum in other bands (e.g. 700 MHz and 2.6 GHz bands) the excessive assignment of 2.1 GHz rights of use would limit a bidder's options in other bands.¹⁶⁵

¹⁶⁵ For example, given ComReg's cap proposals (375 MHz overall cap and 70 MHz sub 1 GHz cap)

6.232 Therefore, ComReg does not believe that Eir has made a particularly convincing case in respect of the competition concerns stated to be underlying its 2.1 GHz band specific cap proposal.

Eir's claim that ComReg's proposal would maintain the same level of asymmetry in the market

6.233 ComReg does not agree that its sub-1 GHz proposal or overall cap proposal would maintain the same degree of asymmetry in the market given the assessment earlier in this section, including as illustrated in Figure 1 above.

6.234 For example, assuming an overall competition cap of 375 MHz, ComReg observes that:

- Eir could bid for up to 190 MHz (375 MHz less 185 MHz) in Time Slice 1 and up to 220 MHz in Time Slice 2;
- Vodafone could bid for up to 195 MHz (375 MHz less 180 MHz) in both time slices;
- Three could bid for up to 155 MHz (375 MHz less 220 MHz) in both time slices;
- Imagine and Dense Air could bid for up to 315 MHz (375 MHz less 60 MHz) in both time slices; and
- A new entrant could bid up to 375 MHz in both time slices.

6.235 Indeed, ComReg observes that Three's proposals, which would not take into account existing spectrum holdings, are ideal examples of spectrum caps that would maintain the same level of spectrum holding asymmetry in the market (see again Figure 1 above).

Eir's submission regarding asymmetry with Vodafone

6.236 ComReg does not find this submission convincing for reasons including the following:

- DotEcon's observation that the caps would prevent the asymmetry between Eir and Vodafone from exceeding the maximum possible level of asymmetry between Eir and Three, and that it did not see

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- If Three targeted all of the 2.1 GHz Band in order to deny it to other bidders it would only be able to acquire 2 X 15 MHz in the remaining bands if it was assigned up to the sub 1 GHz cap (2 x 10 MHz).
 - If Vodafone targeted all of the 2.1 GHz Band in order to deny it to other bidders, it would only be able to acquire 2 x 5 MHz in the remaining bands if it was assigned up to the sub 1 GHz cap (2 x 15 MHz).

any particular reason why Vodafone should not be able to increase its own spectrum holdings within these bounds;

- in that regard, and for reasons similar to ComReg's assessment of Three's 700 MHz proposal, ComReg would question the plausibility of a proposal that restricted Vodafone's (or any other potential bidder's) ability to acquire spectrum rights where such accumulations would not be likely to distort competition under Regulation 9(11); and
- as noted above, Eir has greater scope to increase its holdings relative to Vodafone given its lower existing holdings and any increase in asymmetry between Vodafone and Eir would only arise because Vodafone had a higher valuation for those additional rights of use.

Eir's alternative asymmetry metric

6.237 In relation to Eir's view that the difference between the largest and smallest holdings as a percentage of the largest holding constitutes a more appropriate metric of spectrum asymmetry ("Alternative Metric"), ComReg firstly observes that Eir does not provide a clear indication of the level of asymmetry it considers suitable under its alternative metric. Further, ComReg observes that by ignoring intermediate operators, which clearly affect downstream competition, Eir's Alternative Metric may lead to a competition cap being set incorrectly because it fails to account for all available spectrum.¹⁶⁶

6.238 In addition, ComReg notes that the difference between Three's and Eir's spectrum holdings was equal to 80 MHz at the time of the merger, and 95 MHz at present. Under Eir's alternative metric these differences give an asymmetry of 44% and 34% respectively. A cap of 390 MHz or 405 MHz in the Proposed Award would be consistent with such asymmetries. As noted below, ComReg intends to set the overall competition cap at 375 MHz based on the DotEcon methodology. Under this metric, the worst case asymmetry would be 85 MHz, which is broadly the same as the asymmetry at the time of the merger.¹⁶⁷

ComReg's proposals for the specific level of the overall cap

6.239 First, while ComReg aims to provide bidders with flexibility to acquire additional

¹⁶⁶ In that regard, ComReg would highlight the following example from DotEcon:

"Consider the case where the intermediate operator was not in the market, and its spectrum was not in use (i.e. the total amount of available spectrum was lower). Our measure of asymmetry would be higher, but Eir's would remain the same. Since this would be likely to represent a lessening of competition, it seems appropriate that the metric should consider the total amount of spectrum available when measuring asymmetry."

¹⁶⁷ A cap of 375 MHz could at most result in asymmetry of 23%, which is significantly lower than the level of asymmetry at the time of the merger (44%) and lower than the current asymmetry (34%).

spectrum rights of use, it is particularly concerned with preventing distortions to competition given the changes to market structure since the 2012 MBSA. In particular, the reduction of MNOs from four to three since the 2012 MBSA (following the EC's approval of the merger of Three and Telefonica O2) means that the potential impacts of distortions to competition arising from any extreme asymmetries in spectrum holdings following the Proposed Award are likely to be higher, including the risk of the MNO with the smallest spectrum holding not being able to effectively compete, thereby leading to the possible creation of an effective duopoly.

6.240 In that regard, ComReg notes a number of relevant points.

- The higher the overall cap the greater the possible level of absolute asymmetry between Eir and Three. For example:
 - A cap of 375 - 380 MHz would approximately retain the level of asymmetry between MNOs (in terms of total MHz) present after the Merger and the 3.6 GHz Award (i.e. 85 – 100 MHz);
 - whereas a cap of 420 MHz would potentially increase the asymmetry to 160 MHz (around 20% of available spectrum holdings). This would be double the absolute asymmetry prior to the award;
- The level of asymmetry between Three and Eir cannot be definitively controlled through the overall cap as other bidders may well compete in the Proposed Award.

6.241 Further, as noted by DotEcon, the previous assessment of asymmetry assumed that the MNOs would acquire as much of the available spectrum rights of use between themselves as allowed by the proposed caps and did not take account of the possibility that other bidders might win some of the spectrum. In that regard, there are at least three potential categories of users of the award spectrum, as identified in the 'Spectrum for Award' RIA: mobile operators, fixed wireless operators, and small cell operators. As such, there may be non-MNO bidders or new entrants competing in the Proposed Award.

6.242 As the more relevant market in relation to the Proposed Award is for mobile services, it is particularly important to consider the impact on competition in that market if non-MNOs were assigned spectrum in the Proposed Award. If Three and Vodafone win spectrum up to the cap and bidders (other than Eir) also win spectrum, the level of asymmetry between Eir and Three would increase by the amount won by other non-MNO bidders. It is difficult to make any clear assumptions about what non-MNO bidders and/or new entrants may be assigned. However, it is clear that the higher end of the range carries a greater

risk of extreme asymmetries between MNOs arising.

6.243 Even relatively small amounts of spectrum assigned to non-MNOs could result in an extreme asymmetry between Eir and Three. For example:

- If Three and Vodafone both win up to a cap of 420 MHz and if other bidders won 50 MHz, the overall level of asymmetry between Eir and Three could increase to 265 MHz (26% of total holdings). Under this scenario, Eir would not be assigned any spectrum rights to use;
- If Three and Vodafone both win up to a cap of 400 MHz and if other bidders won 50 MHz, the overall level of asymmetry between Eir and Three could increase to 210 MHz (20% of holdings) and Eir could potentially be assigned up to 35 MHz. However, it is also worth noting that this would include any 700 MHz rights of use, of which Eir could be assigned up to 30 MHz, constraining the extent to which an appropriate package of coverage and capacity spectrum could be assigned; and
- If Three and Vodafone both win up to a cap of 375 MHz and if other bidders won 50 MHz, the overall level of asymmetry between Eir and Three could increase to 135 MHz and Eir could potentially be assigned 85 MHz. If Eir was assigned up to 30 MHz in 700 MHz Duplex this would leave 55 MHz across other bands.

6.244 At the same time, ComReg recognises the tension between allowing bidders the opportunity to obtain sufficiently large contiguous blocks of spectrum to meet their existing and likely future requirements, and simultaneously excluding excessively concentrated outcomes where downstream competition would be harmed. In setting the competition cap range, ComReg observed that even at the lower end of the range, bidders would have opportunities to obtain a considerable amount of additional spectrum. For example, under an overall cap of 375 MHz:

- Three, which has the largest existing holdings, would be able to increase its holdings by 155 MHz or 55%; and
- Vodafone, which has the second largest existing holdings, would be able to increase its holdings by 180 MHz or 80%.

6.245 Further, ComReg notes that significant progress has been made in the orderly transition¹⁶⁸ of the 3.6 GHz Band and this progress has facilitated the commencement of a substantial amount of the 3.6 GHz Band spectrum rights of use meaning operators have additional capacity available with which to meet

¹⁶⁸ 3.6 GHz Band Transition Progress Report 2019 - Document 19/115.

existing and future requirements whilst also safeguarding effective competition in 3 operator market. Further, ComReg notes that the 2.3 GHz Band has traditionally been reserved the band for military use in other jurisdictions while (subject to progress on the migration of RurTel) the entire band is potentially being made available in the Proposed Award.

6.246 Therefore, at the lower end of the competition cap range there remains opportunities for incumbents to increase their holdings by considerable amounts.

6.247 In light of the above, ComReg considers that an overall spectrum competition cap of 375 MHz would, compared to alternative caps within the 380 – 420 MHz range, better guard against distortions to competition arising from extreme asymmetries in post-award spectrum holdings, particularly in light of:

- the post-merger MNO market structure, including the risk of the MNO with the smallest spectrum holding not being able to effectively compete, thereby leading to the possible creation of an effective duopoly; and
- the significant potential for non-MNO bidders to acquire spectrum in the Proposed Award and thereby exacerbate the level of asymmetry between Three and Eir post-award.

6.248 In addition, an overall cap at this level would still allow the MNOs with larger spectrum holdings to acquire a considerable amount of spectrum rights (e.g. Three and Vodafone could still increase their current holdings by 55% and 80%, respectively) and noting that MNOs are only now just starting to deploy networks using their 3.6 GHz Band rights of use.

6.249 For the sake of completeness, ComReg refers to its consideration of its 700 MHz proposal against more relevant regulatory obligations and principles (e.g. proportionality) and, given its assessment of alternative overall cap proposals and other submissions, observes that the substance of those considerations would also apply in respect of its overall cap proposal.

6.250 Finally, ComReg would clarify that any 2.1 GHz, 2.3 GHz and 2.6 GHz holdings obtained under the Proposed Award may be taken into account for a competition cap/s for the award of sufficiently substitutable and/or complementary spectrum bands in the future.

6.5.5 ComReg's updated position

Sub-1 GHz Cap

6.251 In light of the above, and the assessment in Section 6.1.4 of the interaction between caps and the CCA, ComReg is of the view that it has not received any

information that would reasonably require a modification to its sub-1 GHz cap proposals as set out in Document 19/59R, except to clarify that any 700 MHz Duplex holdings obtained under the Proposed Award may be taken into account for a competition cap/s for the award of sufficiently substitutable spectrum bands in the future.

Overall Cap

6.252 ComReg considers that an overall spectrum competition cap of 375 MHz would, compared to alternative caps within the 380 – 420 MHz range, better guard against distortions to competition arising from extreme asymmetries in post-award spectrum holdings, particularly in light of:

- the post-merger MNO market structure, including the risk of the MNO with the smallest spectrum holding not being able to effectively compete, thereby leading to the possible creation of an effective duopoly; and
- the significant potential for non-MNO bidders to acquire spectrum in the Proposed Award and thereby exacerbate the level of asymmetry between Three and Eir post-award.

6.253 In addition, an overall cap at this level would still allow the MNOs with larger spectrum holdings to acquire a considerable amount of spectrum rights (e.g. Three and Vodafone could still increase their current holdings by 55% and 80%, respectively) and noting that MNOs are only now just starting to deploy networks using their 3.6 GHz Band rights of use.

6.254 Finally, ComReg would clarify that any 2.1 GHz, 2.3 GHz and 2.6 GHz holdings obtained under the Proposed Award may be taken into account for a competition cap/s for the award of sufficiently substitutable and/or complementary spectrum bands in the future.

6.6 Fees

6.6.1 Summary of ComReg's view in Document 19/59R

6.255 In Sections 7.8 to 7.11 of Document 19/59R, ComReg set out its views on spectrum fees.

6.256 ComReg considered matters in relation to fees that would potentially apply to rights of use assigned under the Proposed Award. In that section ComReg examined the following:

- Why the use of minimum prices is appropriate for the proposed award;
- Methodology for deriving minimum prices for the proposed award;

- The minimum price structure and whether a split of the minimum price into an upfront (SAF) and ongoing (SUF) portion is appropriate; and
- The level of the minimum price including the proposed upfront SAF and ongoing SUFs that will be applicable to rights of use assigned under the Proposed Award.

6.257 ComReg was firstly of the view that a minimum price is warranted where there is an opportunity for bidders to obtain access to valuable spectrum at a price below its real economic value.

6.258 ComReg considered four possible approaches¹⁶⁹ to setting the minimum price and was of the preliminary view that it was appropriate to use benchmarking above other approaches to determine a conservative minimum price taking into account uncertainty in benchmark estimates.

6.259 ComReg also outlined its preliminary view that minimum prices should consist of a two-part payment structure composed of an upfront fee (“minimum SAF”) and an on-going stream of indexed Spectrum Usage Fees (“SUFs”) apportioned on a 40/60 basis.

6.260 Taking into account the benchmarking analysis provided by DotEcon, ComReg was of the preliminary view that the following fees should apply.

¹⁶⁹ Low but non-trivial, administrative costs, business modelling and benchmarking.

Table 3: Minimum Price SAF & Annual SUF¹⁷⁰

Bands	Lot size	Time Slice	Minimum SAF, €	SUF¹⁷¹, €
700 MHz	2×5 MHz	1 & 2	7,541,000	1,169,000
2.1 GHz	2×5 MHz	1	1,377,000	615,000
2.1 GHz	2×5 MHz	2	1,694,000	615,000
2.3 GHz (2300 – 2330)	30 MHz	1	1,013,000	274,000
2.3 GHz (2300 – 2330)	30 MHz	2	755,000	274,000
2.3 GHz	5 MHz	1	227,000	62,000
2.3 GHz	5 MHz	2	169,000	62,000
2.3 GHz	10 MHz	1	455,000	123,000
2.3 GHz	10 MHz	2	339,000	123,000
2.6 GHz	2×5 MHz	1	455,000	123,000
2.6 GHz	2×5 MHz	2	339,000	123,000
2.6 GHz	5 MHz	1	227,000	62,000
2.6 GHz	5 MHz	2	169,000	62,000

6.6.2 Views of respondents to Document 19/59R

6.261 Eir, Three and Vodafone agree with the proposed minimum price split on a 40/60 SAF/SUF basis.

6.262 Vodafone is also of the view that the minimum price should not be set at the final prices reached in other countries as auction prices may have been driven by distortions in those auctions.

6.263 Vodafone supports and promotes the GSMA position paper “GSMA Response

¹⁷⁰ ComReg has rounded minimum prices to the nearest 1,000 for the purpose of this consultation.

¹⁷¹ Subject to CPI index link

to the RSPG Report on Efficient Awards and Efficient Use of Spectrum” noting that:

- *“Reserve prices serve only one purpose - to establish the opportunity cost of the next best use.”*
- *If spectrum is sold it sells from a higher price than the value to the next alternative user and if it remains unsold it will still be of marginal value to that next best user.*

6.264 Vodafone proposes that reserve prices should be reduced for the following reasons.

- Results from outside Europe should be excluded as those markets are different to Ireland.
- Prices for some bands are on a downward trend (e.g. 2.1 GHz) and there is no process for this trend to be reflected.
- The various coordination issues and uncertain transition significantly reduces the value of the 2.3 GHz Band and this is not reflected in the benchmark figure.
- ComReg should expect spectrum prices per MHz to fall relative to the 2012 4G auction given the increase in supply of spectrum and the limited ability to monetize 5G services.

6.265 Three contends that minimum prices should be reduced and puts forward the following views:

- ComReg needs to avoid the possibility of choking off demand by setting reserve prices too high and benchmarking can only give reasonable indications of market price if the samples are taken from several comparable awards.
- Total revenues derived from harmonised spectrum bands have declined in recent years whereas the volume of spectrum in use has increased so valuations can be expected to be lower in the 5G era.
- Three does not agree that the use of a geometric mean gives enough certainty that the benchmark prices will avoid choking off demand.
- ComReg has included some incorrect references in its benchmark in its view and these should be removed.
- Minimum prices should be reduced by one standard deviation in order to

provide a margin for price discovery.

- It is not appropriate to use 800 MHz and 900 MHz benchmarks as 700 MHz is being awarded when there is already a significant volume of sub-1 GHz in use.
- Using samples from the previous 10 years is inappropriate as the business case for acquiring spectrum today is not comparable.
- The 2.1 GHz benchmark is incorrect as the spectrum sold in the 3G era had a significantly different business case. This benchmark should be adjusted to use only recent examples in Three's view.

6.266 Eir contends that the benchmarked prices for a significant proportion of the observations from other awards are below the minimum prices for the proposed award. For example:

- Eir estimates that between 25% and 50% of the benchmarks are below the minimum price proposed for the 700 MHz Duplex.
- Eir estimates that the median benchmark for the other bands are closer to the median than the first quartile.

6.267 In light of the above, Eir finds it difficult to agree with ComReg's view that the proposed minimum prices are conservative. A more appropriate basis for minimum prices would be no higher than the lower quartile of each distribution.

6.268 Notwithstanding, Eir notes that if a pay-as-bid auction format were used instead of a CCA, Eir would be content for the existing minimum prices to remain in order to reduce the potential benefits of strategic demand reduction.

6.6.3 Updated Information

6.269 ComReg notes that it is currently conducting a review of the Weighted Average Cost of Capital ("WACC") which includes an assessment of the mobile WACC. In that regard, ComReg has published a preliminary WACC for the mobile sector.¹⁷² Any changes to the mobile WACC would impact present discounted values used by DotEcon. However, given that the latest WACC is preliminary, ComReg intends to update minimum prices at the next consultation once the new and final WACC estimates are available.

6.270 ComReg also notes that a number of spectrum awards have taken place since the publication of Document 19/59R which might have a limited effect on

¹⁷² Review of Weighted Average Cost of Capital (WACC) • Mobile Telecommunications • Fixed Line Telecommunications • Broadcasting (Market A and Market B) – Document 19/54.

benchmarks, DotEcon will update all benchmarks prior to the commencement of the Proposed Award and the minimum prices will be reviewed in light of any changes to the benchmarking output.

6.6.4 DotEcon updated view

6.271 DotEcon notes that, contrary to the arguments put forward by Vodafone and the GSMA, minimum prices also help to minimise scope for strategic bidding aimed at keeping prices low and/or speculative participation. Setting minimum prices at an appropriate level requires a balancing of these considerations and the need to avoid choking off demand.

6.272 DotEcon notes that it used the geometric mean of prices achieved in previous awards, rather than the arithmetic mean to provide a better central estimate of licence prices. DotEcon does not make any claim that the use of the geometric mean is guaranteed to not choke off demand. However, it is more robust than the arithmetic mean and therefore an improvement on the previous approach.

6.273 DotEcon is confident that the proposed minimum prices are below the likely clearing prices in the award. In this regard, we also highlight that:

- the proposed minimum price for the 700 MHz Duplex is in line with the minimum prices for the 800 MHz and 900 MHz bands in the 2012 multiband award in Ireland; and
- the proposed minimum price for the 2.1 GHz band is in line with the minimum price for the 1800 MHz band in the 2012 multiband award in Ireland, and the minimum prices proposed for the 2.3 GHz and 2.1 GHz bands are significantly lower still.

6.274 The prices achieved in the 2012 multiband award of seven years ago were significantly higher than the minimum prices set out for the proposed award.

6.275 In relation to Vodafone's suggestion that non-European awards should be excluded from the analysis, DotEcon notes that the benchmarking analysis already recognises that some awards are more relevant than others. In particular, non-European awards have already been considered as part of the benchmarking estimates.

6.276 In respect of the 700 MHz minimum price, DotEcon notes that it has included the 800 MHz and 900 MHz data points as part of the analysis. This provides some additional evidence that can be used as input to the determination of minimum prices (noting that non-parametric tests suggest the samples across the three bands could reasonably be considered to come from the same distribution). The observed mean including the 800 MHz and 900 MHz Bands is very similar to the 700 MHz Band only and has made very little difference to

its recommendations.

- 6.277 DotEcon believes that using the last 10 years in determining a benchmark is appropriate. Given the amount of time that has elapsed since the Dot-com bubble, DotEcon is of the view that awards in the last 10 years are unlikely to be affected and the time period considered can be extended beyond the 5-year timeframe that has typically been applied in previous benchmarking exercises for ComReg.
- 6.278 DotEcon strongly disagrees with Eir's suggestion that the minimum prices proposed would be appropriate under one auction format but not under another. Whether a pay-as-bid auction or a CCA is used (or any other auction format is used) is entirely irrelevant when it comes to the question of whether minimum prices are appropriate or not. DotEcon can see no justification for linking the level of fees to the proposed auction format, and it is difficult to accept Eir's argument that the minimum prices are too high given that it would consider them appropriate using a different auction format.
- 6.279 DotEcon disagrees that the use of benchmarking leads to a ratcheting up of prices over time (as claimed by Vodafone). If an award is competitive then the minimum prices have no bearing on the final prices achieved (other than to the extent that they have prevented bidders from artificially keeping prices low). Minimum prices are also typically set conservatively relative to the benchmark values, so final prices for an award can be determined by the market and there is scope for spectrum prices to fall over time as well as increase. Vodafone has not provided any real examples or evidence that a benchmarking approach is inappropriate.

6.6.5 ComReg's assessment of respondents' views

- 6.280 ComReg addresses each of the issues raised by respondents above in turn noting that where respondents raise similar matters, ComReg considers these together.

Vodafone

- 6.281 In relation to Vodafone's reference to the arguments set out in the GSMA report, ComReg agrees with DotEcon that minimum prices also help to minimise the scope for strategic bidding aimed at keeping prices low and/or speculative participation. Setting minimum prices at an appropriate level requires a balancing of these considerations and the need to avoid choking off demand.
- 6.282 Further, ComReg previously addressed¹⁷³ Vodafone's support for the' claim

¹⁷³ Radio Spectrum Management Strategy 2016 to 2018 Response to Consultation on ComReg's radio spectrum management strategy – Document 16/49.

that “*reserve prices serve one purpose only, to establish the opportunity cost of the next best use, and therefore to ensure that if spectrum is sold it sells for a higher price than the value to next alternative users and if it remains unsold, it will still be of marginal value to that next best user, and be assigned to them*”. In that regard, ComReg observed that this statement appears to be based on a misunderstanding of what opportunity cost is, given that:

- reserve prices are not typically designed to establish the opportunity cost of the next best use;
- it is the function of an auction, and the interaction of bidders in same, to determine the opportunity cost of spectrum, not the reserve price;
- the opportunity cost of awarding spectrum means a winner would need to pay at least the amount that the highest value alternative user of the spectrum would be prepared to pay¹⁷⁴; and
- unsold spectrum rights are typically not subsequently assigned to an undetermined “next best user”.

6.283 In relation to Vodafone’s suggestion that the need for reserve prices demonstrates a lack of confidence in the auction model, ComReg agrees with DotEcon that reserve prices (or minimum prices) are typically set in the context of being a part of the auction design that adds to the overall model for achieving an efficient outcome. It is not the case that they are used as a separate tool for propping up deficiencies in an auction format.

6.284 In Section 7.8.2 of Document 19/59R, ComReg set out in detail why the use of minimum prices is appropriate for the proposed award. This approach aims to balance the need to set minimum prices at a sufficiently high level to avoid creating incentives for strategic demand reduction and/or collusion against the risk that the minimum price will be set too high of choking off efficient demand.¹⁷⁵ Once this balance has been achieved it is the interaction of bides during the award that determines the outcome.

6.285 ComReg would also note that minimum prices have important functions beyond the auction. While, the upfront fee is determined during the auction, SUFs (which are a component of the minimum price) are paid over the duration of the licence. In that regard, ongoing SUFs are an important tool for ensuring the efficient use of the radio spectrum as they provide incentives for licence holders

¹⁷⁴ ComReg’s observes that its 2012 MBSA award used a similar approach where each winning bid and, collectively, each and every group of winning bidders, were required to pay a sufficient amount so that there was no other bidder or group of bidders that would be prepared to pay more

¹⁷⁵ concerns that a premature award of spectrum may inefficiently displace valuable future uses or lead to excessive take up simply because the price is low;

to consider the opportunity cost of holding rights of use throughout the period of the licence and return them to ComReg if they are not being used.

6.286 In relation to Vodafone's view that results from outside Europe should be excluded, DotEcon notes that an assessment of European awards only has already been considered. DotEcon has specifically reported competitive awards in Europe only for the last 10 years and this data is given most weight in determining the minimum prices; therefore, Vodafone's suggested approach is that which has been already followed.

6.287 In relation to Vodafone's view that there is a downward trend in the price of certain bands (particularly 2.1 GHz Band), ComReg agrees with DotEcon that concerns around a downward trend in 2.1 GHz prices are overstated because:

- the substantially higher prices in this band were outliers at the start of the century;
- the 'trend' does not appear to affect the later part of the 2.1 GHz data set; and
- the proposed minimum price for new 2.1 GHz licences is significantly below the geometric mean for competitive awards (worldwide) in the last 10 years.

6.288 Further, as noted above, DotEcon will provide a benchmarking update prior to the award process. In this way, any more recent benchmarks will be considered, taking account of any more recent trends.

6.289 In relation to Vodafone's view that various coordination and transition issues reduce the value of the 2.3 GHz Band, ComReg notes that it has already adjusted the 2.3 GHz minimum price to account for the reduced population that may arise under a partial migration scenario. Para 7.331 of Document 19/59R noted that "*the minimum price for the 2300-2330 MHz frequency specific lot has been adjusted to account for the reduced population that would be the case under the "no migration scenario"*". In this case, the population was reduced by 1.2 million in line with the assessment provided by Plum. In light of updated information, the affected population has been reduced to around 800,000 given the recent migration of RurTel users. ComReg will update the 2.3 GHz minimum price prior to the beginning of the award process when full information about the nature of any coordination issues will be known.

6.290 In relation to Vodafone's view that ComReg should expect spectrum prices per MHz to fall relative to the 2012 4G auction and Three's view that revenues have declined in recent years, ComReg notes that it previously addressed these views in Document 16/49 noting that that so long as the minimum price does

not choke off demand, it is for the auction and the interaction of bidders in same to determine the opportunity cost/market value of spectrum rights. Such matters are for bidders to consider and reflect in their bids. Further, as noted by DotEcon even if the value of spectrum has fallen since those previous awards, the proposed minimum prices are still likely to be below the market clearing prices and are appropriate for the Irish market and this award.

6.291 ComReg notes its long-standing position that the benchmarking approach proposed/used in these matters has sought to estimate a minimum price that would be below final prices and, at the same time, is sufficiently high to reduce incentives for distorted bidding behaviour such as gaming and speculative bidding. As noted above, benchmarking is not used to estimate the final prices that should be paid by bidders in auctions, and ComReg again recalls that it is the function of an auction, where it is required, to determine the actual market value of particular spectrum rights.

6.292 Finally, ComReg agrees with DotEcon that the use of benchmarking has not lead to a ratcheting up of prices over time (as claimed by Vodafone). If an award is competitive then the minimum prices have no bearing on the final prices achieved (other than to the extent that they have prevented bidders from artificially keeping prices low). As noted previously, final prices are determined by the interaction of bidders during the award process and recent awards have been effective in achieving this.

Three

6.293 In relation to Three's view that the use of the geometric mean does not give enough certainty that reserve prices will not choke off demand, ComReg agrees with the views of DotEcon. The use of the geometric mean as the reference point is not guaranteed to not choke off demand, but it is more robust than using the arithmetic mean and therefore is an improvement on the previous approach. In that regard, ComReg notes that the use of a geometric mean provides additional protection against the risk of choking off demand, noting that even with the previous approach (as used in 3.6 GHz and MBSA) final award prices were significantly greater than the minimum prices. Furthermore, DotEcon's approach to outliers has also removed data points that could have pushed the price per MHz per capita higher.

6.294 In relation to Three's and Vodafone's view that minimum prices should be reduced (by one standard deviation according to Three), ComReg notes that no convincing evidence has been presented by any respondent to demonstrate that the proposed minimum prices are too high. Three or Vodafone have not identified any reason why minimum prices are too high or why reducing minimum prices by one standard deviation would resolve the unspecified issue. Further in response to Three, ComReg notes that minimum prices set at a

conservative level already provide bidders with a margin to provide for price discovery during the award noting that the increments per round are typically small ¹⁷⁶ thereby providing bidders with price discovery opportunities over a number of rounds.

- 6.295 In relation to Three's view that it is not appropriate to use 800 MHz and 900 MHz benchmarks, ComReg notes the views of DotEcon that the bands are substitutable and that this provides additional evidence that can be used as input to the determination of minimum prices (noting that non-parametric tests suggest the samples across the three bands could reasonably be considered to come from the same distribution). DotEcon also notes that there is no statistically significant evidence to suggesting that the bands cannot be pooled to produce a conservative minimum price estimate.
- 6.296 Further, ComReg agrees with DotEcon that the observed means are similar with and without the additional data points. For example, ComReg notes that the 700 MHz only benchmarks (last 10 years European) results in a price per MHz per capita of €0.36 compared to €0.38 where 800 MHz and 900 MHz bands are included. This should also be viewed in the context of the minimum prices for the 800 MHz and 900 MHz Bands in MBSA of 2012 which was based on a price of €0.38 per MHz/capita. All 13 lots were sold for many multiples of the reserve price. Alternatively, the difference between the 700 MHz only benchmark and 700 MHz, 800 MHz and 900 MHz benchmark is around 5% and would likely be accounted for by one price increment in the proposed award.
- 6.297 In relation to Three's view that using samples from the previous 10 years is inappropriate as the business case for acquiring spectrum today is not comparable, ComReg agrees with the views of DotEcon that it is necessary to look at previous awards over an appropriately long timeframe, in order to provide a reasonable (and meaningful) number of data points. Further, while the business cases may have changed over the years, the spectrum on offer in the upcoming award is still important and valuable spectrum for WBB services.
- 6.298 In relation to Three's concern that setting a reserve price too high would likely choke-off demand and prevent legitimate spectrum utilisation, ComReg notes that its approach to-date has been to select a minimum price that is sufficiently high to reduce incentives for distorted bidding behaviour but subject to the risk of choking-off demand being sufficiently low. In this way, the final price paid will continue to be determined by the competitive auction process, a position which both Three and Vodafone support. Further, ComReg notes that Three's concerns are not supported by the outcome of the 2012 MBSA or the 3.6 GHz

¹⁷⁶ The magnitude of the price increment applicable to each Lot Category will be determined by ComReg, taking into account factors such as the level of excess demand in the previous round. See Section 3.5.1 of Document 16/71.

Award, where similar concerns were expressed by interested parties. In particular, ComReg observes that the final prices in that award would indicate that the minimum prices adopted were set well below the value of the rights of use of spectrum that were sold.

Eir

- 6.299 In relation to Eir's views that the proposed minimum prices would be appropriate in order to reduce the potential benefits of strategic demand reduction if a pay-as-bid format is used, ComReg agrees with DotEcon that whether a pay-as-bid auction or a CCA (or any other auction format is used) is entirely irrelevant when it comes to the question of whether minimum prices are too high. If the minimum prices set are high enough to choke off demand and risk an inefficient outcome, this would be the case under any auction format because the auction format does not affect bidders' valuations.
- 6.300 ComReg notes that if Eir is of the view that minimum prices are appropriate and presumably would not choke off demand in a pay-as-bid auction, there is no reason to think that the same is not true with a CCA. A bidder's value for a block of spectrum does not depend on the type of auction format. If a bidder was willing to compete for spectrum in a pay-as-bid auction at certain minimum prices, there is no reason to think the same bidder would not compete in a CCA with the same minimum prices.
- 6.301 It would appear that Eir does not think that the proposed minimum prices would choke off demand (if it did it would not consider them appropriate for any auction format) but rather it has concerns around the auction format, which ComReg has already assessed. In that regard, ComReg considers Eir's subsequent views that minimum prices should be lowered to be without merit.

6.6.6 ComReg's updated position

- 6.302 In consideration of the views provided by respondents and the updated views of DotEcon, ComReg is of the preliminary view that the conservative ranges as recommended by DotEcon and set out in Table 1 remain appropriate, save for any changes that may arise following any benchmarking that will take place prior to the Proposed Award and taking account of any new WACC as may be published by ComReg and any population changes with regards to the 2.3 GHz Band.

Chapter 7

7 Licence conditions

7.1 Introduction

7.1 Regulation 10(1) of the Authorisation Regulations provides that ComReg may only attach those conditions listed in Part B of the Schedule to the Authorisation Regulations to rights of use for radio frequencies for the provision of ECN and ECS.

7.2 In Chapter 8 of Document 19/59R, ComReg set out its proposed licence conditions, noting that the development of those proposals had been guided by, among other things:

- ComReg's statutory functions, objectives and duties, including in particular its obligations under the Authorisation Regulations;
- the relevant European legislation related to the bands¹⁷⁷;
- the rationale and licence conditions used previously by ComReg for bands used for similar purposes (e.g. the licence conditions used in the 2012 MBSA and 3.6 GHz Award);
- the rationale and licence conditions proposed in Document 14/101 and the submissions received to that consultation;
- the "Connectivity Studies" - comprising of the Frontier Connectivity Report (18/103a and 18/103b), Oxera Connectivity Report (18/103c) and the DotEcon Connectivity Report (Document 18/103d) along with ComReg's Information Notice (Document 18/103);
- the Plum 2.6 GHz and 2.3 GHz Co-existence Reports published as Documents 19/59c and 19/59d, respectively; and
- other relevant information including international practice.

7.3 In this chapter ComReg sets out its further consideration of those proposals, having carefully considered relevant responses to Document 19/59R, again taking into consideration the above factors and also taking into account updated information including, in particular;

¹⁷⁷ See Annex 4 for a listing of the relevant EC, EU and ECC Decisions for the Proposed Bands.

- Plum Report Document 19/124c;
- Plum's radar testing report, Document 19/124d; and
- Oxera Report, Document 19/124f.

7.4 The following licence condition proposals are discussed in this chapter:

- service- and technology-neutrality;
- non-exclusive assignment of spectrum;
- coverage and rollout;
- quality of service;
- notification of the termination of a technology;
- potential wholesale access (MVNO) conditions
- spectrum transfer, spectrum leasing, spectrum hoarding; and
- technical conditions.

7.2 Service and technology neutrality

7.2.1 Summary of ComReg's view in Document 19/59R

7.5 Service and technology neutrality is the principle that spectrum rights of use, and the conditions applied thereto, should not preclude the provision of any specific service and/or the use of any technology. In Section 8.2 of Document 19/59R, ComReg stated that it was appropriate to apply a service and technology neutral approach to the licensing of the spectrum bands proposed for award (the "Proposed Bands"). This would permit the deployment of all technologies and services that comply with the relevant EC/CEPT harmonisation decisions for those bands.

7.2.2 Views of respondents to Document 19/59R

7.6 Two respondents, Eir and Vodafone, submitted comments on this issue, both of whom supported ComReg's proposal to apply a service and technology neutral approach to the licensing of the Proposed Bands.

7.6.1 Updated information

7.7 In June 2019¹⁷⁸, the GSMA published a report entitled “*The Benefits of Technology Neutral Spectrum Licences*” which relevantly stated:

“Technology neutral spectrum licensing is widely recognised as best practice when assigning spectrum to mobile operators. It enables mobile operators to refarm spectrum used for GSM (2G) or 3G to 4G and 5G at a pace that’s driven by market demand. This maximises spectral efficiency in a technical sense and also maximises efficient use of spectrum. As a result, users benefit from better mobile broadband coverage, higher data speeds and lower mobile data prices than would otherwise be the case.”

7.2.3 ComReg’s updated position

7.8 Accordingly, ComReg’s proposal to apply a service and technology neutral approach to the licensing of the Proposed Bands remains unchanged from Document 19/59R.

7.3 Non-exclusive assignment of spectrum rights

7.3.1 Summary of ComReg’s view in Document 19/59R

7.9 In Section 8.3 of Document 19/59R, ComReg considered that it would be appropriate to permit spectrum in the Proposed Bands to be used for other uses on a non-interference and non-protected basis. In the interests of appropriate regulatory consistency, ComReg proposed that the non-exclusivity condition to be attached to spectrum rights in the Proposed Bands would be substantively the same as the non-exclusive provision contained in the licences issued in the 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz bands¹⁷⁹.

7.10 While no existing EC decision explicitly obliges Member States to designate

¹⁷⁸ Available at: <https://www.gsma.com/spectrum/wp-content/uploads/2019/06/Benefits-of-Technology-Neutral-Spectrum-Licences.pdf>

¹⁷⁹ The following definitions are included in [S.I 251 of 2012](#)

“Non-exclusive”, in relation to a Licence, means that the Commission is not precluded from authorising the keeping and possession by other persons of other apparatus for wireless telegraphy on a Non-Interference and Non-Protected Basis in one or more of the 800 MHz, the 900 MHz and the 1800 MHz bands;

“Non-Interference and Non-Protected Basis” means that the use is subject to no harmful interference being caused to any Radiocommunication Service, and on which no claim may be made for the protection of apparatus used on this basis against harmful interference originating from Radiocommunication Services;

and make available the 2.3 GHz band on a non-exclusive basis, compared to relevant EU Decisions for the other Proposed Bands, ComReg nevertheless considered that it would be appropriate to make the 2.3 GHz Band available on a non-exclusive basis as this would, among other things:

- provide for consistency across the Proposed Bands;
- accord with standard practice for licensing spectrum bands; and
- make provision for any future EC decision on this band which may, given the approach in other similar harmonised bands, include obligations to make spectrum available on a non-exclusive basis.

7.11 Furthermore, ComReg noted that, while the scope of spectrum assignments for other uses in these bands is yet to be determined, these assignments have generally been made through a process which first considers the impact on licensed services, either via harmonisation at European level or authorisation at national level, with the knowledge of the licensee.

7.3.2 Views of respondents to Document 19/59R

7.12 ComReg received one response, from Eir, in relation to this matter. Eir noted that the issue of licences in the Proposed Bands on a non-exclusive basis would be in line with current practices.

7.3.3 ComReg's updated position

7.13 Accordingly, ComReg's proposal to attach a non-exclusivity condition to spectrum rights issued in the Proposed Award remains unchanged from Document 19/59R.

7.4 Coverage and rollout obligations

7.4.1 Introduction and Background

7.14 In Document 19/59R, ComReg set out a detailed discussion and analysis of the background and context to establishing the appropriate coverage and rollout obligations. In particular, ComReg discussed:

- how mobile services were provided at the time of the 2012 MBSA;
- the usages, perceptions and experiences of mobile phone users as identified by the Behaviour and Attitudes Study and published in 2017 (Document 17/100a);

- the results of ComReg’s mobile handset ¹⁸⁰and building material testing¹⁸¹;
- ComReg’s decision to permit the use of mobile phone repeaters¹⁸²; and
- relevant advice ComReg received on different aspects of providing connectivity in Ireland in the Connectivity Studies.

7.15 In light of the analysis in Document 19/59R, ComReg characterised the policy issue as determining the *“appropriate mobile coverage obligation that contributes to improving the overall consumer connectivity experience, mindful of the availability of other technologies and networks and likely developments in same.”* ComReg observed that this may mean, for example, that it might be more appropriate to achieve certain consumer connectivity requirements through technologies and networks other than mobile alone.

7.16 ComReg also set out other national and international information relevant to the consideration of the appropriate coverage obligations for the Proposed Bands, which included:

European Information

- Article 6(1) of the RSPP Decision (Decision No 243/2012/EU¹⁸³) which obliges Member States to take all necessary steps to ensure that sufficient spectrum for coverage and capacity purposes is available within the Union, and to achieving the target for all citizens to have access to broadband speeds of not less than 30 Mbit/s by 2020;
- EU Decision (EU)2017/899¹⁸⁴ which, among other things, obliges Member States, when authorising or amending rights of use in the 700 MHz band, to:
 - take due account of the need to achieve the target speed and quality objectives set out in Article 6(1) of Decision No 243/2012/EU, including coverage in predetermined national priority areas where necessary, such as along major terrestrial

¹⁸⁰ Documents 19/67 (Data performance), 18/109 (Voice performance)

¹⁸¹ Document 18/73

¹⁸² Document 18/58 , Decision D08/18

¹⁸³ DECISION No 243/2012/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2012 establishing a multiannual radio spectrum policy programme.

¹⁸⁴ DECISION (EU) 2017/899 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union.

transport paths, for the purpose of allowing wireless applications;
and

- o assess the need to attach conditions to the rights of use for frequencies within the 700 MHz frequency band and, where appropriate, shall consult relevant stakeholders in that regard;
- “European 5G roadmap”¹⁸⁵ - which, among other things, aims to see 5G connectivity in large cities and along major transport routes of every European country by 2025;
- BEREC publications on mobile coverage¹⁸⁶ and spectrum authorisations and award procedures including coverage obligations¹⁸⁷;
- RSPG opinions and reports, in particular the joint BEREC and RSPG joint report on facilitating mobile connectivity in “challenge areas”¹⁸⁸ and the RSPG Report on Efficient Awards and Efficient Use of Spectrum¹⁸⁹; and
- the use of coverage obligations elsewhere¹⁹⁰.

7.17 In addition, ComReg noted that it is mindful of the new “connectivity” general objective (and related recitals) in the EECC:, including

- promoting connectivity and access to, and take-up of, very high capacity networks, including fixed, mobile and wireless networks, by all citizens and businesses of the Union (Article 3(2)(a);
- where “...that connectivity objective translates, on the one hand, into aiming for the highest capacity networks and services economically sustainable in a given area, and, on the other, into pursuing territorial cohesion, in the sense of convergence in capacity available in different area” (Recital 23) (emphasis added); and
- “Ensuring widespread connectivity in each Member State is essential for economic and social development, participation in public life and social and territorial cohesion. As connectivity and the use of electronic communications become an integral element to European society and

¹⁸⁵ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: “[5G for Europe: An Action Plan](#)”

¹⁸⁶ BOR (18) 237: BEREC Common Position on information to consumers on mobile coverage,

¹⁸⁷ BOR (18) 235 BEREC Report on practices on spectrum authorization and award procedures and on coverage obligations with a view to considering their suitability to 5G

¹⁸⁸ [Document RSPG18-001](#)

¹⁸⁹ [Document RSPG16-004 FINAL](#)

¹⁹⁰ Information on the coverage obligations used elsewhere in Europe is available from Cullen International (a pay subscription website)

welfare, Member States should strive to ensure Union-wide wireless broadband coverage. Such coverage should be achieved by relying on the imposition by Member States of appropriate coverage requirements, which should be adapted to each area served and limited to proportionate burdens in order not to hinder deployment by service providers.” (Recital 109) (emphasis added).

Relevant national information

- Mobile Phone and Broadband Taskforce (“the MPBT”) - Focus Group Report on Mobile Coverage¹⁹¹ provides guidance with respect to categories of location where high quality reliable mobile coverage should be made available as a priority. The focus group determined that the services available on a mobile phone at the categories of locations should be mobile voice calls, text messages and basic data connectivity, such as web browsing; and
- respondents views to Document 18/60, where two respondents (Nera and Eir) commented on coverage:
 - Eir submitted that encouraging more mobile coverage in rural areas will be an important factor to take into account when considering the appropriate format for a Proposed Award and queries whether the objectives of the potential award process will be informed by the MPBT; and
 - Nera submitted that symmetric coverage obligations set at “precautionary” levels which can be achieved commercially should not distort bidding. It cautioned against the setting of onerous obligations to a sub-set of licences which then sell a discount to unencumbered spectrum. Instead, it submits that there are better solutions, for example, having a further auction stage in which operators compete in a reverse auction to reduce their payments for spectrum in return for committing to non-commercial coverage targets in specified geographic areas.

700 MHz band being considered separately to 2.1 GHz, 2.3 GHz and 2.6 GHz bands

7.18 In setting out its proposed coverage and rollout obligations for the Proposed Bands in Document 19/59R, ComReg identified that the 700 MHz Duplex would be considered separately to the other Proposed Bands for reasons including that:

¹⁹¹ MPBT - [Focus Group Report on Mobile Coverage](#)

- it is widely accepted that when targeting the provision of a good quality of service over wide areas, sub-1 GHz bands, which have more favourable propagation characteristics, should be used¹⁹²;
- of the Proposed Bands, the 700 MHz Duplex is best suited for this purpose, which is acknowledged in EU Decision (EU) 2017/899¹⁹³ and the 700 MHz EC Decision¹⁹⁴; and
- by comparison, the other Proposed Bands have propagation characteristics where the propagation losses due to terrain, buildings, trees etc. are greater than sub-1 GHz bands and, as such, are typically more suited¹⁹⁵ to (i) support additional capacity to mobile devices over relatively short distances and (ii) provide connections to rooftop locations over wider areas where near line of sight can be obtained.

7.4.2 700 MHz Duplex - summary of ComReg's view in Document 19/59R

700 MHz Duplex - key questions considered

- 7.19 In Section 8.4 of Document 19/59R, ComReg set out its view on coverage obligations for the proposed award and, for obligations applicable to the 700 MHz Duplex, ComReg considered three key questions being in summary:
- A. if a coverage obligation should apply, whether it should be on a geographic or population basis. ComReg considered that it should be on a population basis, informed by a number of factors as set out in paragraphs 8.50 to 8.64 of Document 19/59R;
 - B. In light of A, whether any coverage obligation should also include an indoor coverage dimension. ComReg considered that, due to the many challenges in providing mobile reception indoors from outdoor base stations¹⁹⁶, that indoor coverage could be better achieved by other means – in particular, by operators enabling Native Wi-Fi on their networks and/or by the installation of mobile phone repeaters by consumers in the home. Accordingly, ComReg proposed:

¹⁹² Many respondents (including Three, ESNB and Viatel) to Document 14/101 acknowledged the differences in propagation characteristics between sub 1 GHz bands (i.e. the 700 MHz) and higher frequency bands (including the 2.3 and 2.6 GHz Bands proposed at that time) that are used for capacity.

¹⁹³ See, for example, recitals 2, 4 and 9.

¹⁹⁴ See, for example, recitals 2 and 3,

¹⁹⁵ Further ComReg has set out the distinctions between coverage and Performance Bands in the Spectrum Bands for Award RIA in Chapter 4.

¹⁹⁶ See Annex 12.

- a condition on any rights of use issued on foot of the Proposed Award that if a mobile voice service is provided to a licensee's customers (including to third party customers of a licensee, for example in the case of MVNO arrangements) then it must also provide Native Wi-Fi; and
- in order to ensure that this benefit is available to consumers in a timely way after the award of spectrum, an obligation to enable this functionality within 1 year of licence commencement.

C. In light of A and B, whether any minimum speed (e.g. expressed in terms of Mbit/s) or quality of service should apply to any such obligation/s. In summary ComReg noted that:

- the 700 MHz EC Decision identifies the importance of the 700 MHz Band for the provision of data services to meet the increasing demand for wireless data and that the band is a valuable asset for deploying cost efficient terrestrial wireless networks with high capacity coverage;
- while voice calls remain an important use for consumers, networks are moving to provide voice services over data in the future (e.g. VoLTE);
- investments in 2G and 3G networks have matured, with additional investments likely to be targeted at 4G/5G networks. Considering this, investments in 2G and 3G technologies to improve voice services would likely be inefficient given operators are likely to begin transitioning to 4G/5G networks over time; and
- further, any obligation to improve voice services over 2G/3G networks would not likely be proportionate given the availability of alternative and more efficient measures to achieve the same ends (e.g. VoLTE).

7.20 Considering the above, ComReg considered that, in order to be effective, any proposed coverage obligation for 700 MHz Duplex rights ought to apply to data services.

7.21 ComReg considered different speed levels¹⁹⁷ and came to the preliminary view that the proposed **outdoor population coverage** should primarily focus on a

¹⁹⁷ I.e. 3 Mbit/s, 30 Mbit/s and 50 Mbit/s.

minimum data rate of 30 Mbit/s for a single user at cell edge¹⁹⁸.

7.22 At the same time, ComReg recognised that the main outdoor service issues across all types of consumers (rural and urban) relate to voice calls and, given the clear benefits to both consumers and operators¹⁹⁹ for the deployment of VoLTE, ComReg proposed:

- a condition on any rights of use issued on foot of the Proposed Award that if (i) the rights holder has deployed LTE and (ii) a mobile voice service is offered on its network to a licensee's customers (including to third party customers of a licensee, for example in the case of MVNO arrangements), then it must also provide VoLTE²⁰⁰; and
- to ensure that the benefits of VoLTE are made available to consumers in an orderly and sustainable way, that this obligation would need to be met across all sites within 2 years of licence commencement and that 50% of the sites should be met within 1 year of licence commencement.

700 MHz Duplex – Coverage ranges

7.23 Considering the above three key questions, ComReg then set out the regulatory options for consideration in its draft RIA (Annex 7 of Document 19/59R) which considered the following 4 options:

- **Option 1** - Impose no coverage obligation.
 - This would mean that all licensees would have full flexibility to choose how extensive their rollout would be regardless of the amount of 700 MHz Duplex rights it was assigned. For example, a licensee could choose to provide no services, only to provide services in high density areas, or choose to differentiate itself as a provider with an extensive network footprint;
- **Option 2** - Impose a coverage obligation to provide a minimum level of coverage sufficient to serve between 70% and 90% of the population, together with a minimum data rate of 30 Mbit/s for a single user at cell edge. Option 2 was informed by, among other things:

¹⁹⁸ Notwithstanding, ComReg observed that there may be situations where a 30 Mbit/s obligation would not be appropriate, For example, in the case of a new entrant only winning rights in the 700 MHz band, or an existing MNO only winning 2x5 MHz in the 700 MHz band. In such instances, proposed that lower data rates would apply.

¹⁹⁹ As considered and identified in paragraphs 8.94-8.98 and paragraphs 8.221-8.225 of Document 19/59R.

²⁰⁰ This obligation would extend to providing this for any MVNO's carried on the network.

- in the 2012 MBSA, a 70% coverage obligation was considered necessary given there was no guarantee that market forces alone would ensure the efficient use of spectrum, and that this level would prevent cherry picking (such as in densely populated areas)²⁰¹; and
 - Oxera's view that operators providing coverage of 90% population at 30 Mbit/s appears likely even if no coverage obligation were set;
 - **Option 3** - Impose a coverage obligation to provide a minimum level of coverage to serve between 90% and 95% of the population, together with a minimum data rate of 30 Mbit/s for a single user at cell edge. This option was informed by Oxera's view that such a coverage obligation would appear feasible for an existing MNO to meet; and
 - **Option 4** - Impose a coverage obligation to provide a minimum level of coverage to serve 95 - 99.5% of the population, together with a minimum data rate of 30 Mbit/s for a single user at cell edge. This option would provide high speed services to very high levels of the population.
- 7.24 ComReg specified that each of the above options would be symmetric such that all 700 MHz licensees would be required to meet the same minimum coverage targets under the same conditions.
- 7.25 Considering the above options and its draft RIA, ComReg set out its preliminary view that:
- the preferred option for existing MNOs is Option 3;
 - the preferred option for new entrants is Option 2.
- 7.26 ComReg also noted DotEcon's advice, as set out in its 'Coverage and Spectrum Awards' Report (Document 18/103d), which identified two types of coverage obligations:
- **precautionary** coverage obligations - where the obligations do not exceed the levels of coverage that might be expected anyway from well-functioning competition between network operators; and
 - **interventionist** coverage obligations - which can be expected to constrain the commercial choices of network operators and force coverage in excess of competitively determined levels.

²⁰¹ 70% of the population corresponds cities and towns including towns under 500 population but with at least 50 inhabited houses.

7.27 ComReg noted that its preferred options would likely be precautionary in nature. In contrast, Option 4 would likely correspond to an interventionist coverage obligation as commercial coverage would not likely exceed the obligation and operators would incur a cost for providing the additional coverage (i.e. the difference between what would have been provided commercially and the interventionist obligation).

700 MHz Duplex Coverage Obligations proposals

7.28 Taking the above preferred options, and informed by, amongst other things, the Oxera Report and the output of the MPBT focus group on mobile coverage, ComReg further specified its proposed coverage obligations, including the actual percentage of the target obligation, other associated coverage obligations, the rollout period and the specific locations to be served as part of the coverage obligations.

7.29 The proposed coverage obligations applicable to the 700 MHz Duplex as set out in Document 19/59R are summarised below.

Existing MNOs

7.30 An existing MNO which wins at least 2×10 MHz of spectrum in the 700 MHz Duplex would need to meet:

- coverage levels as set out in Table 4 below; and
- coverage at specific locations as set out in Table 5 below.

Table 4: Obligations on an existing MNO winning at least 2×10 MHz in the 700 MHz Duplex

Outdoor Coverage Service (Single User Throughput Cell Edge)	Coverage dimension	Coverage level to be met in:			Source of data Oxera/Real Wireless Study - Document 18/103c
		3 Years	5 Years	7 years	
30 Mbit/s	Population	85%	92%	95%	Scenario 2 results
30 Mbit/s	Motorways	75%	85%	90%	Scenario 2 results
30 Mbit/s	Primary Roads	60%	75%	80%	Scenario 2 results
3 Mbit/s	Population	99%	99%	99%	Scenario 2 results
3 Mbit/s	Geographic area	90%	91%	92%	Scenario 2 results

Table 5: Coverage at specific locations

What	Where	When
Outdoors: 30 Mbit/s (Single User Throughput Cell Edge)	<p>Specific locations as set out in Annex 8 which include</p> <ul style="list-style-type: none"> • Business and technology Parks (including strategic sites): The IDA identifies a list of 31 business and technology Parks and 9 Strategic Sites • Hospitals: the Health Service Executive (HSE) identifies a list of the 48 public and 17 private hospitals • Higher Education Campuses: The Higher Education Authority (HEA) identifies a list of 8 Universities, 11 Institutes of Technology and 5 other colleges • Air and Sea Ports: the Department of transport tourism and Sport (DTTAS) identifies a list of the 7 main airports and the Irish Maritime Development Office (IMDO) identify a list of the 7 passenger sea ports. • Train and bus stations: the National transport Authority identifies the busiest 144 train stations and Bus Eireann identifies a list of the main 16 bus stations • Top visitor attraction information points: Failte Ireland identifies a list of the top (21) fee charging and (21) free entry visitor attractions. 	<p>For each category</p> <p>70 % in 3 years</p> <p>90 % in 5 years</p> <p>100 % in 7 years</p>

7.31 In addition, an existing MNO winning less than 2×10 MHz of 700 MHz Duplex spectrum would need to meet the above obligations, except that the minimum single user throughput cell edge level would be 20 Mbit/s.

New entrants

7.32 Furthermore, ComReg further specified that a new entrant winning at least 2×10 MHz in the 700 MHz Duplex and 2×20 MHz of capacity spectrum or equivalent (i.e. 40 MHz of TDD spectrum) would need to meet the obligations as summarised in Table 6 below.²⁰²

²⁰² This obligation is informed by amongst other things, Oxera's Scenario 8, which models a new entrant obtaining rights of use for 2 x 10 MHz in the 700 MHz Band along with 2 x 20 MHz in the 2.6 GHz Band.

Table 6: Obligations on new entrant winning 2×10 MHz in the 700 MHz Duplex and 2×20 MHz of capacity spectrum²⁰³

Outdoor Coverage Service (Single Throughput Edge) User Cell	Coverage dimension	Coverage level to be met			Source of data Oxera/Real Wireless Study - Document 18/103c
		4 Years (2024)	6 Years (2027)	10 years (2030)	
30 Mbit/s	Population	75%	80%	90%	Scenario 8 results

7.33 Finally, ComReg also specified that a new entrant winning 2×10 MHz or 2×5 MHz of 700 MHz Duplex would need to meet the above obligation, except that the single user throughput cell edge level would be reduced to 20 Mbit/s and 10 Mbit/s, respectively. ComReg also observed that these levels are of course minima and it would be open for any new entrant to advance these levels further.

700 MHz Duplex - measuring and monitoring the coverage obligation

7.34 In light of a variety of information available to it in Document 19/59R²⁰⁴, and in summary, ComReg considered that:

- the ComReg Outdoor Coverage Map supported by field measurements (where appropriate) would be a key component in assessing compliance with the coverage obligations;
- while acknowledging 5G networks will be rolled out over time, LTE technology is expected to continue to be used by operators in delivering data to consumers for some time and, in this regard, ComReg proposed to use a reference signal receive power (“RSRP”) metric for determining the coverage levels of an LTE network;
- an obligation be established to incentivise operators to upgrade sites with

²⁰³ Or equivalent: i.e. 40 MHz of TDD spectrum.

²⁰⁴ Including:

- ECC Report 256 (17 October 2016) – LTE coverage Measurements;
- BEREC Common Position on information to consumers on mobile coverage BOR 18 (237) - BOR (18) 237: BEREC Common Position on information to consumers on mobile coverage;
- previous approaches used by ComReg in assessing compliance with coverage obligations;
- approaches used in other member states;
- the analysis and modelling conducted by Oxera/Real Wireless in Document 18/103c; and;
- information from national sources such as for example ComReg’s Outdoor Coverage Map.

additional spectrum, make use of improvements in technology such as new standards including carrier aggregation and carrier sharing or extension techniques;

- how the above techniques are deployed on a network would determine the benefits in terms of increasing the range of a cell for a given throughput;
- it would establish a RSRP base level of -95dBm as a proxy for a 30 Mbit/s SUTP level for a 10 MHz downlink carrier. Where capacity increasing techniques are used, such as carrier aggregation and /or deploying additional bandwidth, a lower RSRP value could be used;
- while further considerations are needed in this regard, ComReg noted that carrier aggregating an additional sub-1 GHz carrier of 10 MHz could result in approximately 5 - 10dB lower RSRP when targeting a given throughput;
- appropriate RSRP levels for the other throughput obligations as set out in section 8.4.6 of Document 19/59R (specifically 20 Mbit/s, 10 Mbit/s and 3 Mbit/s) be explored;
- drive tests could be used to assess compliance with the measurement for certain metrics. For example, roads, population or to verify the modelling conducted by ComReg; and
- as new technologies are rolled out, ComReg would consider how this could influence meeting the proposed coverage obligations.

7.35 Finally, ComReg proposed to consider this matter further in advance of its response to consultation and draft decision and welcomed views from interested parties on the above.

7.4.3 700 MHz Duplex – summary of submissions received to Document 19/59R

7.36 ComReg received four submissions commenting to its proposed 700 MHz Duplex coverage obligations (from Vodafone, Eir, Three and Mr. Young).

7.37 As a number of the submissions received from respondents (in particular from Vodafone and Mr. Young) commented on the Oxera Connectivity Report and the DotEcon Connectivity Report. These views, and ComReg's assessment of same are summarised in Annex 3. ComReg also obtained further reports from Oxera and DotEcon assessing these views, published as Document 19/124b and 19/124f respectively.

7.38 To aid the presentation of this material, the submissions are set out grouped under, firstly, the key questions considered by ComReg and, secondly, on the specific proposals.

Proposal to focus on population coverage

7.39 One respondent (Vodafone) supported focusing on population rather than geographic coverage for reasons including that:

- it is useful to promote the best service to customers; and
- population coverage is a better driver of coverage than targeting geographic area.

7.40 While the other respondents did not directly comment on this question, ComReg notes, from the broader points being made in their submissions that they relate to the targeting of population coverage²⁰⁵.

Proposals that the obligation should focus on outdoor coverage and that a Native Wi-Fi obligation should apply to address indoor coverage

7.41 Two respondents (Eir and Vodafone) commented on whether the coverage obligation should focus on indoor or outdoor coverage, while one respondent (Three) did not directly respond but indicated agreement to the proposed obligations in the main.

7.42 Three respondents (Eir, Three and Vodafone) commented on the proposed Native Wi-Fi obligation. As these obligations are related, the submissions are presented and considered together.

Proposal that the obligation should focus on an outdoor coverage obligation

7.43 Two respondents (Eir and Vodafone) agree with ComReg's proposals that the coverage obligations should focus on outdoor coverage for reasons including that:

²⁰⁵ For example

- Eir states: "*ComReg (based on previous Oxera work) considers (see ¶ 8.90) that a population coverage obligation should "primarily focus on a minimum data rate of 30Mbit/s for a single user at cell edge". eir agrees...*"
- Vodafone refers to ComReg comments in Document 18/103 on the Oxera's population coverage observations.
- While Three expressed caution as to targeting any higher levels of coverage, it provided general support for ComReg coverage obligations proposed which are focussed on achieving population coverage in the first instance.
- Mr. Young: identifies eircodes/ addresses as being the target for coverage

- it is useful to promote the best service to customers (Vodafone);
- measuring outdoor coverage gives the most consistent results (Vodafone);
- *“It is not possible to effectively monitor compliance with an indoor coverage obligation and modern building materials, as assessed by ComReg, make it impossible to predict indoor coverage levels”* (Eir);
- Eir, citing ComReg’s view in paragraphs 8.77 and 8.88 of Document 19/59R, agrees that indoor coverage is better addressed by the use of Native Wi-Fi and mobile phone repeaters.

Proposed Native Wi-Fi obligation

7.44 Three respondents (Eir, Three and Vodafone) commented on ComReg’s proposed Native Wi-Fi obligation. Whereas Vodafone agrees with the proposed obligation, submitting that it is useful to promote the best service to customers, Eir and Three disagree with the proposals for reasons including that:

- a) it would seem that ComReg may be acting *ultra vires* in relation to this proposed obligation because none of the conditions in Part B of the schedule to the Authorisation Regulations 2011 apply (Eir);
- b) Native Wi-Fi is a competitive differentiator (Eir);
- c) the proposed obligation would contradict the technology-neutral approach normally taken by ComReg (Three);
- d) *“It is possible that there will be a new entrant bidder in the auction who intends to focus only on data provision. For this bidder a mandatory requirement to provide [Native Wi-Fi] represents an unnecessary burden that is a barrier to their acquisition of spectrum. This would particularly be the case if they intended to bid for a relatively small portion of the total spectrum available”* (Three);
- e) *“[a]ll licensees who provide voice service will eventually introduce the SIP/IMS technology when they are sure that the customer experience over a mobile network will be as good as that which customers have so far experienced with circuit-switch voice. This is not yet the case today for voice over VoWi-Fi and VoLTE. ComReg should let licensees decide whether or when it is most appropriate to introduce services like VoLTE”* (Three); and
- f) *“We note that VoWi-fi is normally supplied over a fixed broadband service (normally using wired/fibre infrastructure), and that it would be incorrect to include any requirement in spectrum licences to require a wireless provider*

to invest in infrastructure to provide fixed network services. This would be an inappropriate condition that would discriminate against wireless only service providers in favour of wired ones.”.(Three).

Proposal on the quality of service to be provided, in particular, the proposal to set a 30 Mbit/s SUTP target obligation for outdoor population coverage and proposals for voice call quality obligation (VoLTE)

Target of 30 Mbit/s SUTP

- 7.45 Four respondents (Eir, Mr. Young, Three and Vodafone) commented on this proposal. Three respondents (Eir, Three and Vodafone) supported it, while one respondent (Mr. Liam Young) submitted that a higher throughput obligation should be targeted.
- 7.46 Eir, Three and Vodafone also provided some qualifications:
- this will necessitate a 2x10 MHz lot in the 700 MHz Duplex (Eir); and
 - operators should be able to achieve this using all of the frequencies resources that they have available and frequency aggregation where useful (Vodafone).
- 7.47 Mr. Young submits that ComReg should consider a 50 Mbit/s obligation within 3 years and which would increase to 100 Mbit/s in 5 years, and referenced the recent German 3.6 GHz award in this regard. Further Mr. Young also submits that the obligation should include a latency requirement of 10ms within 3 years.

VoLTE obligation

- 7.48 ComReg received submissions on its proposed VoLTE obligation, which are outlined and considered in section 7.5 below.

Proposed coverage percentages and associated timings

The target level of 30 Mbit/s 95% outdoor population coverage

- 7.49 Four respondents (Eir, Mr. Young, Three and Vodafone) commented on the proposed coverage percentages and associated timings.
- 7.50 Eir and Three support the proposals, with Three providing the following additional views:
- “[Three]... cautions that any further obligations would likely act as a deterrent to bidders in the auction”, and
 - “Bearing in mind that Ireland has a particularly challenging rural

population profile, these obligations are at the upper-end of what network operators could be expected to meet under competitive commercial conditions”.

7.51 Vodafone submits that the proposed obligation is beyond what an operator would likely deliver, considers that the appropriate level should be 90% and provided reasons including:

a) a reference to the following statement by ComReg in Document 18/103:

“In the light of these cost estimates, Oxera estimates that there will likely be a commercial incentive to extend 30 Mbit/s MBB coverage to a level in the lower 90 percentile range of population in the period up to 2025. Oxera observes that policy or regulatory interventions could accelerate and/or extend coverage beyond these levels, to a certain extent, but this would require stakeholders to assess carefully the costs and benefits involved”

b) that the Oxera Connectivity Report overstates the development of coverage because, in its view:

- a significant portion of operator budget has been taken with the roll-out of replacement sites. For example, in Dublin up to 30 sites a year are lost as buildings are re-developed, forcing operators to build alternative sites just to maintain coverage;
- due to the use of multiple frequency bands requiring many antennae, and the extensive implementation of tower sharing among operators, much of the tower infrastructure available now required structural upgrade. This increases the cost of adding frequency bands on sites to much higher figure than assumed in Oxera calculations. One specific example of Oxera underestimating cost is that they assume a labour cost of €500 for upgrades. Our experience is that the labour cost is more typically €5,000 per site, including the planning work;
- the count of new sites being built per year has reduced since the data set used by ComReg; and
- in a small number of areas, sites have not been built because all operators have failed to receive the required planning permission;

c) On the basis of its own analysis of coverage benefit, Vodafone agrees that there is no commercial incentive to roll-out coverage beyond a figure in the lower 90% range of population. Given the additional

constraints imposed by planning permission refusal etc. a figure of 90% would be the likely final figure reached without intervention.

7.52 Mr. Young submits that the obligations should be more challenging and, in particular, the obligation for existing MNOs should target 98% population (Eircodes) within 3 years²⁰⁶ and 100 % population (Eircodes) within 5 years²⁰⁷. The reasons provided in support of this proposal include that:

- *“Comreg should study closely the spectrum awards process adopted and subsequent network rollout in Sweden, where 4G LTE coverage has now exceeded 99.9% population coverage, driven by a regulatory intervention, and despite having a much lower population density than Ireland.” ; and*
- *“Comreg should study closely the outcome of the recent licence award process overseen by the Bundesnetzagentur in Germany, which concluded in June 2019, where similar interventionist coverage and download speed conditions to those recommended in this submission have been successfully imposed and accepted by licencees.”*

The other associated coverage obligations as set out in Table 17 of Document 19/59R

7.53 Three and Eir agree with the associated coverage obligations as set out in Table 17 of Document 19/59R.

7.54 Vodafone, however, states that it is not clear whether this incidental coverage is part of licence coverage requirements.

Proposed obligations at specific locations

7.55 Two respondents (Three and Vodafone) commented on the proposed specific location obligations.

7.56 Three, while supporting ComReg’s coverage obligations generally, cautioned that companies with a large portfolio of tower assets will be encouraged to inflate their prices around the specific locations. It suggested that the licensees should have some degree of flexibility as to how to achieve coverage in these locations allowing operators to move away from landlords charging excessive rents.

7.57 Vodafone made a number of observations on these proposals including that:

- it is not clear how these proposed obligations align with a precautionary

²⁰⁶ As identified above, this would be for 50 Mbit/s

²⁰⁷ As identified above, this would be for 100 Mbit/s

approach;

- many of the sites are owned by the State and it has had specific issues in accessing suitable sites on State land. Further, it submits that it has brought these issues to the MPBT and cites the following examples:
 - previously the IDA proposed a joint operator access in 2011, which was tendered but did not proceed, and Vodafone submits that there is no consistent process for access to IDA property;
 - the Health Service Executive setting un-economically high prices for access to hospitals, which Vodafone claims has not been addressed; and
 - Irish Rail has proposed uneconomic prices for access to additional railway stations sites;
- it has experienced numerous planning permission issues at these locations, citing an example of the visitor attraction information points where many of these are located in national parks or areas of special amenity;
- it will continue to cooperate with the MPBT to assist with the rollout of additional coverage. However, as the solutions are not within the control of the operators, Vodafone submits that it is unsafe at this stage to set a timescale for the MPBT resolving these issues. Vodafone states that it would be happy to commit to 100% of these locations in 7 years – however, without a prior commitment on site access, the requirement should be approximately 50%.

Proposals in relation to the measuring and monitoring of the obligations

7.58 Three respondents (Three, Vodafone and Mr. Young) submitted views in relation to the measuring and monitoring of the proposed obligations.

7.59 Vodafone and Mr Young:

- proposed all bands available to a rights holder should be able to be used to contribute to meeting the proposed obligations; and
- supported carrier aggregation as a mechanism by which to meet the proposed throughput obligations.

7.60 Vodafone also submits that the population coverage should be calculated with reference to an RSRP of -105 dBm with the use of carrier aggregation.

- 7.61 Mr. Young suggests that the population coverage obligation needs to be further defined as it leaves scope for various interpretations as to how to measure the obligation and proposes that either an Eircode coverage or a combination of geographic coverage and Eircode coverage should be considered by ComReg.
- 7.62 Vodafone proposes that using the radio planning tools already established by ComReg to measure covered population would provide the best basis for compliance measurement and that sharing the parameters used by ComReg in this tool would ensure an efficient compliance process.
- 7.63 Vodafone notes that drive tests and other coverage measurements are reviewed but their role in licence conditions and compliance is unclear.
- 7.64 Three notes that ComReg should specify the percentage of coverage probability associated with these coverage obligations, which it suggests is quite important for radio coverage design²⁰⁸.

7.4.4 700 MHz Duplex – ComReg’s assessment

- 7.65 ComReg's coverage proposals are informed by relevant background information and expert reports, as set out in Document 19/59R and summarised in section 7.4.2 above. Vodafone acknowledges this. Accordingly, ComReg in considering and addressing the submissions received does not propose to restate this information, where a suitable reference can instead be used.
- 7.66 In considering the submissions, ComReg does so using the same structure as above, i.e. on the key questions considered and then on the specific proposals.

Proposals to focus on population coverage

- 7.67 ComReg notes that all respondents agree with focussing on a population metric for coverage and, for the reasons as set out in Section 8.4.4 A of Document 19/59R, ComReg’s preliminary decision is that the proposed coverage obligations should focus on population coverage.

Proposals that the obligation should focus on outdoor coverage and that a Native Wi-Fi obligation should apply to address indoor coverage (and quality of service)

- 7.68 Two respondents (Eir and Vodafone²⁰⁹) agreed with ComReg that the coverage

²⁰⁸ Three provides the following example - (e.g: 92% of geographic area but with 85% coverage probability, or 90% coverage probability).

²⁰⁹ Noting that while Three did not directly comment on the outdoor coverage obligation, agreed with the overall proposals which consisted of targeting an outdoor coverage obligation.

obligation should focus on outdoor coverage.

7.69 However, two respondents (Three and Eir) did not agree with the proposed obligation for Native Wi-Fi to address indoor coverage.

7.70 Firstly, ComReg observes that Eir's view that a Native Wi-Fi obligation should not be applied is somewhat at odds with its views supportive of targeting outdoor obligation including that:

- *"It is not possible to effectively monitor compliance with an indoor coverage obligation and modern building materials, as assessed by ComReg, make it impossible to predict indoor coverage levels"*; and
- citing ComReg's view identified in paragraph 8.77 and 8.88 of Document 19/59R, it agrees that indoor coverage is better addressed by the use of Native Wi-Fi and mobile phone repeaters.

7.71 Second, and by way of background to its assessment of respondents' views, ComReg recalls that:

- Regulation 10 of the Authorisation Regulations provides that ComReg may only attach such conditions as are listed in Part B of the Schedule to the Regulations and any attachment shall be non-discriminatory, proportionate and transparent and shall be in accordance with Regulation 17 of the Framework Regulations;
- Part B of the Schedule to the Authorisation Regulations identifies the nature of the conditions which may be attached to spectrum rights of use for ECS, and conditions 1 and 2 are relevant in the present case:
 1. *"Obligation to provide a service or to use a type of technology for which the rights of use for the frequency has been granted including, where appropriate, coverage and quality requirements"*; and
 2. *"Effective and efficient use of frequencies in conformity with the Framework Directive and Framework Regulations."*
- Regulation 17 of the Framework Regulations relevantly:
 - obliges ComReg to ensure that all types of technology for ECS may be used in relevant ECS frequency bands unless an appropriate restriction is required to, *inter alia*, ensure technical quality of service and/or ensure efficient use of spectrum;
 - obliges ComReg to ensure that all types of ECS may be used in relevant ECS frequency bands unless an appropriate restriction is

required to, *inter alia*, avoid the inefficient use of radio frequencies;
and

- requires that measures that require an ECS to be provided in a specific band shall be justified in order to ensure the fulfilment of a general interest objective, including:
 - promoting social, regional or territorial cohesion; or
 - avoidance of inefficient use of radio frequencies.
- other provisions particularly relevant to this issue include:
 - promoting the interests of users within the Community
 - ensuring that users, including disabled users, derive maximum benefit in terms of choice, price and quality;
 - encouraging efficient investment in infrastructure and promoting innovation; and,
 - encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources.
- recital 15 of the EECC states:

“The services used for communications purposes, and the technical means of their delivery, have evolved considerably. End-users increasingly substitute traditional voice telephony, text messages (SMS) and electronic mail conveyance services by functionally equivalent online services such as Voice over IP, messaging services and web-based e-mail services. In order to ensure that end-users and their rights are effectively and equally protected when using functionally equivalent services, a future-oriented definition of electronic communications services should not be purely based on technical parameters but rather build on a functional approach. The scope of necessary regulation should be appropriate to achieve its public interest objectives.... ... The definition of electronic communications service should eliminate ambiguities observed in the implementation of the definition as it existed prior to the adoption of this Directive and allow a calibrated provision-by-provision application of the specific rights and obligations contained in the framework to the different types of services.”
- paragraphs 8.25 and 8.26 of Document 19/59R, where ComReg identifies the results of the mobile consumer experience survey, which

highlighted in particular that consumers experience voice and text service issues indoors;

- MPBT - [Focus Group Report on Mobile Coverage](#)²¹⁰ and in particular the 2017 Action Point 39 which notes that “*All operators will introduce WiFi calling, VoLTE and other network feature and functionality enhancements at the earliest juncture and report on progress to the Taskforce Implementation Group.*” While this is a 2017 action point, it remains important particularly since these network features and functionality enhancements remain unavailable for certain consumers; and
- all of the Proposed Bands have been identified for International Mobile Telecommunication (IMT) and are particularly suited for delivering voice and text services to consumers.

7.72 In light of the above, ComReg observes that there are number of potential regulatory options available to improve indoor voice and text coverage and quality of service to consumers via the Proposed Bands. As such, ComReg sets out in Annex 13 a draft RIA on the options available to improve indoor coverage and quality of service, being:

- **Option 1** – Do not attach specific indoor mobile voice and text coverage and quality of service obligations.
 - This would mean that all licensees have full flexibility to choose the levels of mobile voice and text coverage and quality of service they would provide indoors.
- **Option 2** – Attach specific indoor mobile coverage and quality of service obligations to improve indoor mobile voice and text services.
 - This would involve an ‘Outdoor-In’ approach where the licensee would be obliged to provide a sufficient signal strength from outdoor base stations to penetrate indoors to ensure indoor mobile voice and text coverage replicates coverage provided outdoors.
- **Option 3** – Attach a Native Wi-Fi (including VoWi-Fi) obligation to rights of use to improve indoor mobile voice and text coverage and quality of service. Specifically:
 - If a licensee provides a mobile voice and/or text services using

²¹⁰ MPBT - [Focus Group Report on Mobile Coverage](#)

rights of use in one or more of the Proposed Bands, then:

- i. it would be obliged use Native Wi-Fi technology on its network in respect of the Proposed Bands to which it holds rights of use to under its licence; and
- ii. it would be obliged to make available Native Wi-Fi voice and/or text services (as appropriate to the type of mobile service/s provided by the licensee) to all customers on its network (including third party customers, such as MVNO customers), where those customers:
 - have established for themselves a suitable Wi-Fi connection; and
 - have a Native Wi-Fi/Wi-Fi Calling-enabled mobile device.

7.73 ComReg's assessment of the potential regulatory options are as set out in Annex 13. Having considered the regulatory options, and in light of the assessment contained therein, ComReg is of the preliminary view that **Option 3** is the overall preferred option because, among other things, it would:

- improve indoor voice and text **coverage**:
 - By using the most effective radio frequencies for indoor connectivity (i.e unlicensed Wi-Fi spectrum bands inside the home), it would provide better indoor coverage levels compared to Option 2 which would use "outdoor" mobile spectrum which would suffer significant penetration loss because of, among other things, modern building materials and therefore have lower levels of indoor voice and text coverage;
 - further, the coverage advantages of Option 3 over Option 2 identified above are likely to increase over time as more existing homes are retrofitted with modern building materials, new homes required to be built with modern building materials, and any changes to the Building Regulations which would increase penetration loss from outdoor signals;
- improve indoor (and outdoor) voice and text **quality of service**:

- By using the most effective radio frequencies for indoor coverage (i.e. unlicensed Wi-Fi spectrum bands), it would provide better indoor coverage levels and, by implication, quality of service compared to Option 2 which would use “outdoor” mobile spectrum which would suffer penetration loss because of, among other things, modern building materials and therefore have lower levels of indoor voice and text quality of service;
- the relevant “outdoor” mobile spectrum which would have otherwise been used to attempt to provide the (poorer) indoor voice or text service is now freed (by virtue of Wi-Fi offload) and this additional capacity can therefore be used to provide a better quality of service to a licensee’s **outdoor** customers;
- it would avoid requiring handsets operating at increased power in attempting to make a connection with outdoor base stations (under Option 2) - noting also that there is also an inherent limitation in this regard; and
- it offers a voice quality above what is currently provided by 2G/3G and an experience comparable to VoLTE (12.65 kbps).
- Promote the **effective and efficient use of frequencies**:
 - it would make more *effective* use of radio frequencies by entailing the use of the frequencies best suited to providing indoor voice and text connectivity (i.e. unlicensed Wi-Fi spectrum within the premises);
 - it would make more *efficient* use of the unlicensed Wi-Fi spectrum bands, which may be relatively less congested than the relevant “outdoor” mobile frequencies (including the frequencies relevant to the Proposed Award) that would otherwise be used to provide the indoor voice and text service;
 - it would make more *effective* use of radio frequencies by entailing the use of the frequencies best suited to providing outdoor mobile services (i.e. the mobile frequencies, including the frequencies relevant to the Proposed Award);
 - it would make more *efficient* use of the relevant “outdoor” mobile spectrum because they would be freed from providing (poorer) indoor voice or text services (by virtue of Wi-Fi offload) and this additional capacity can be used to provide the outdoor mobile services to which it is better suited;

- it would avoid the inefficient investment and inefficient spectrum use (i.e. additional base stations being deployed for the “outdoor” mobile bands and/or operating at potentially higher power levels in an attempt to deliver an attenuated signal indoors) that would otherwise be incurred in trying to provide a (poorer if at all) indoor voice and text service with such frequencies.
- More generally, and in light of the above, Option 3 would:
 - better reflect the increasing availability of high-speed Wi-Fi networks and, indeed, the impending roll-out of the NBP means that Option 3 could provide the above identified benefits across the entire population;
 - in light of the above, better ensure that users derive maximum benefit in terms of choice, price and quality;
 - better support increasing the energy efficiency of mobile networks and of mobile users, noting in particular the challenges with mobile battery usage;
 - be unlikely to result in a distortion or restriction of competition to the detriment of users; and
 - would be suitable for the achievement of the legitimate objectives as there do not appear to be less onerous means by which these objectives and principles could be achieved.

7.74 In light of the above, including as further detailed in the draft RIA, ComReg sets out its assessment of responses received to its proposal.

7.75 First, and for the reasons identified above (including as further detailed in the draft RIA), ComReg does not consider Eir’s submission at **point (a)** (i.e. that the proposed Native Wi-Fi obligation does not have any basis under Regulation 10 of the Authorisation Regulations (including Part B of the Schedule to same)) to be particularly convincing.

7.76 In relation to **point (b)** (competitive differentiator), ComReg outlines its assessment below:

- First, while Option 3 may appear unnecessary, given that two operators have deployed Native Wi-Fi (however - for some, but not all, customers) and the same outcome for indoor mobile voice and text coverage might be achieved through normal competition, Option 3 can play an important role in protecting potential risks to competition as described in Annex 13;

- Second, the purpose of Option 3 is not to eliminate competitive differentiation (as submitted by Eir) but rather to maximise benefits to consumers by appropriately and proportionately addressing evidenced consumer issues (i.e. poor indoor voice coverage and quality per ComReg's 2019 Mobile Phone Consumer Experience Survey) for clearly important consumer services that should be addressed in a well-functioning competitive market over an appropriate period. This is supported by the stakeholder analysis as set out in the draft RIA and operator's commitment to the rollout of Native Wi-Fi. In effect, such an obligation is little different to precautionary coverage obligations which may be met or exceeded by operators but play an important role in preventing any competitive distortions;
- Third, ComReg also notes DotEcon's view that²¹¹ "*if all networks were not timely in offering native Wi-Fi calling, despite the population of enabled handsets growing, this would prima facie suggest a possible competitive failure*". These possibilities may not be likely to arise, however Option 3 would provide reassurance in preventing such adverse outcomes, with little risk of the obligation itself creating unintended distortions or imposing costs;
- Fourth, as coverage and quality are clearly also competitive differentiators for MNOs, this argument is not particularly convincing given the consistent application by ComReg of conditions in respect of coverage and quality of service;

7.77 In relation to **points (c) and (d)**, ComReg would highlight that:

- its proposed obligation is conditional on whether the licensee provides mobile voice or text services; and
- Condition 1 of Part B of the Schedule to the Authorisation Regulations permits obligations to provide a service (in this case Native Wi-Fi voice and/or text services in certain prescribed circumstances) and to use a type of technology (i.e. Native Wi-Fi technology at the network level).

7.78 In relation to **point (e)**, ComReg notes that Three (UK) is already providing this service to its customers including VoLTE and that this challenge has also been overcome across 91 countries globally where 194 operators have commercially deployed VoLTE-HD voice.

7.79 At the same time, ComReg recognises that the deployment of Native Wi-Fi and

²¹¹ Document 18/103d, 'Coverage obligations and spectrum awards a report from DotEcon Ltd, published November 2018 – Section 2.2.2.

VoLTE on a network entails the use of the same underlying technology and, as ComReg proposes to include an obligation in relation to VoLTE as set out in Section 7.5 below over a 2 year timeframe from the commencement date of new licences, that there may be efficiencies in extending the timeframe for the deployment of Native Wi-Fi to 2 years to align with this and to ensure that consumer voice experience is enhanced.

7.80 In relation to **point (f)**, ComReg would clarify that its proposed obligation relevantly requires that customers have established for themselves a suitable Wi-Fi connection (and have a Native Wi-Fi/Wi-Fi Calling-enabled mobile device).

7.81 In light of the above, ComReg is of preliminary Decision:

- that the coverage obligation for rights of use in the 700 MHz Duplex should focus on outdoor coverage; and
- that indoor voice and text coverage and quality of service would be achieved via the following proposed obligation:
 - If a licensee provides a mobile voice and/or text service using rights of use in one or more of the Proposed Bands, then:
 - it would be obliged to use (i.e deploy and maintain) Native Wi-Fi technology on its network in respect of the Proposed Bands to which it holds rights of use to under its licence within 2 years of licence commencement; and
 - it would be obliged to make available Native Wi-Fi voice and/or text services (as appropriate to the type of mobile service/s provided by the licensee) to all customers on its network (including third party customers, such as MVNO customers), where those customers:
 - have established for themselves a suitable Wi-Fi connection; and
 - have a Native Wi-Fi/Wi-Fi Calling-enabled mobile device.

Proposal on the quality of service to be provided, in particular, the proposal to set a 30 Mbit/s SUTP target obligation for outdoor population coverage and proposals for voice call quality obligation (VoLTE)

7.82 In relation to Mr. Young's proposal that ComReg set out a 50 Mbit/s obligation

within 3 years and 100 Mbit/s within 5 years²¹². ComReg notes that in paragraph's 8.86 to 8.91 of Document 19/59R considered whether 30 Mbit/s or 50 Mbit/s may be appropriate for the coverage obligation. Following this, ComReg was of the view that a 30 Mbit/s SUTP obligation is appropriate.

- 7.83 Mr Young's submission that the throughput obligation should be increased may be partly based on his contention that there are certain omissions in Oxera's modelling. However Oxera in its analysis of all the submissions received, which includes those made by Mr. Young, in relation to its report, Document 19/124f, identifies that *"having considered the comments on the report made by respondents to ComReg Document 19/59R we are of the view that the modelling approach and inputs are robust and appropriate, and that the conclusions we draw remain reasonable and justified"*.
- 7.84 Also Mr. Young suggests that ComReg should consider the approach taken in Germany in its recent award. In considering this ComReg notes that DotEcon identifies in its assessment in Document 19/124b that:
- the coverage obligations proposed in Germany are not too dissimilar to those proposed by ComReg, in particular the German proposals include a requirement to cover 98% of premises by the end of 2022, as well as federal highways, major roads and railways. Other main roads need to be covered by 2024;
 - the throughput obligation included in the German Award was for 100 Mbit/s per antenna sector²¹³, which is distinct from the 30 Mbit/s SUTP at the cell edge obligations proposed by ComReg.
- 7.85 In relation to Eir's comment that a 30 Mbit/s obligation would necessitate a 2x10 MHz lot in the 700 MHz band, ComReg agrees with this as proposed in paragraph 8.123 of Document 19/59R. Should an existing MNO obtain less than 2x10 MHz a reduced throughput obligation would apply of 20 Mbit/s.
- 7.86 In relation to Vodafone's submission that operators should be able to make use of all the frequencies resources that they have available and frequency aggregation where useful. ComReg agrees with this proposal, the use of other frequency bands in particular the benefits that carrier aggregation can bring was

²¹² ComReg also notes that Mr. Young contends that this obligation would be to 98% of the population within 3 years and 100% population within 5 years.

²¹³

https://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/Areas/Telecommunications/Companies/TelecomRegulation/FrequencyManagement/ElectronicCommunicationsServices/FrequencyAward2018/20181214_Decision_III_IV.pdf?__blob=publicationFile&v=3 *"The assignment holder must, by 31 December 2022, achieve coverage of at least 98% of households in each federal state with a downlink transmission rate of at least 100 Mbit/s (megabits per second) per sector."*

outlined in ComReg's proposals in Document 19/59R.

7.87 In relation to Mr. Young's proposal that a maximum latency requirement should be added to the obligation, ComReg notes that the proposal of a maximum of 10ms would require the operator to meet the obligation using 5G deployments and potentially supported with fibre backhaul²¹⁴ to base stations. Oxera identify in Document 19/124f that

- *"...the use cases identified in the report were not specific to 5G technology, and therefore do not require 5G-specific networks to be developed. For example, Internet of Things (IoT) and mobile broadband services (MBB) have been around for many years and will continue to be delivered with 4G (LTE) technology as modelled for some time".*
- *"While 5G networks will be deployed and evolve in the future, it would be unreasonable to assume that the MNOs will upgrade their networks with the latest technology (e.g. 5G) or features (e.g. beam-forming) all at once. It is more likely that this will happen gradually, and that 4G technology will remain in the coverage layer of networks for a number of years to come, similar to the way that 2G and 3G technologies remain in use today."*
- *"It is reasonable to assume that service providers (i.e. MNOs) will assess the demand carefully and upgrade the network to deliver services in the most efficient way, and that the MNOs have a good knowledge about the end-user demand for services and the cost of delivering those services."*

7.88 Further, should an obligation be imposed to deploy 5G equipment at each site the network costs would likely increase further, as existing 4G equipment would need to be replaced resulting in potentially a lower percentage of the population achieving 30 Mbit/s.

7.89 ComReg observes that latency of the mobile networks will reduce with the deployment of 5G base stations, but this will be largely driven by use cases and mandating a 10ms latency to high percentage of the population within the obligation period considered by ComReg would likely be beyond what an operator would deliver in a competitive market. In light of the above ComReg does not consider it appropriate to include a specific latency obligation in the Proposed Award.

Proposed coverage percentages and associated timings

7.90 ComReg notes the submissions received in support of its proposed coverage

²¹⁴ Or equivalent backhaul that can provide <1ms latency.

obligations and Three's additional views set out in paragraph 7.50 above.

7.91 **In relation to (a)** above, raised by Vodafone, ComReg notes that Oxera in its report, Document 19/124f provides the following clarification:

- *“Vodafone (in para 16 and 17[of its response]) states its view, while quoting a ComReg summary of the report, that there is no commercial incentive to roll-out coverage beyond a figure in the lower 90% range of population.*

*We note that Vodafone's preference for the lower 90% range is informed by ComReg's summary which cites a roll-out period of **up to 2025**. However, when considering a roll-out period of **up to 2027**, the report states that a population coverage of 95% is possible.²¹⁵ (emphasis added).*

7.92 **In relation to (b)**, ComReg notes that Oxera, in its report has considered Vodafone's response and set out its view and is further considered by ComReg in Annex 3. In summary Oxera note that:

“..having considered the comments on the report made by respondents to ComReg Document 19/59R, we are of the view that the modelling approach and inputs are robust and appropriate, and that the conclusions we draw remain reasonable and justified.”

7.93 **In relation to (c)**, while ComReg notes Vodafone's analysis that there is no commercial incentive to rollout coverage beyond a figure in the lower 90% range of population, ComReg also notes the observations from Oxera as identified above and addition note the following:

- Vodafone claims to already achieve 98% population coverage for 4G, meaning that the coverage footprint already exists and it would in effect only have to focus on the upgrade of existing sites in order to satisfy the QoS aspect of the obligation (i.e. 30 Mbit/s); and
- Rival operators who both have less lower market shares and in some cases (particularly Eir) a less developed network all acknowledge that a 95% rate is commercially achievable. ComReg does not consider it credible that the operator with the most subscribers would provide coverage at a materially lower level than smaller rivals.

7.94 In light of the above, ComReg does not find Vodafone's analysis persuasive in proposing a lower than 95% population coverage obligation.

²¹⁵ ComReg 18/103c, Table 5.8.

7.95 In relation to Mr. Young's proposal that the obligations should be more challenging, and in particular the obligation for existing MNO's should target 98% population within 3 years²¹⁶ and 100 % population within 5 years, ComReg notes:

- it has considered the responses to the specific comments received to the Connectivity reports as set out in Annex 3 and as summarised in Chapter 2 and is of the view that the Connectivity reports are robust and do not warrant amendment; and,
- looking at awards in other European countries, for example Germany and Sweden. The German Award is considered by DotEcon in Document 19/124b and ComReg has considered this above and also in Annex 3. Further ComReg notes that Oxera:
 - considered and provided commentary on the approaches to coverage obligations in other countries in informing its recommendations in Document 18/103c, including the approaches taken in Sweden, Finland, Austria, Denmark and the UK²¹⁷.
 - has carried out detailed modelling of the expansion of the networks in the Irish context taking into account, amongst other things the starting point of networks, the most likely and cost effective mechanisms to the expansion of coverage utilising additional sites and equipment upgrades, and also informed by the possible levels of investment by operators.

7.96 Notwithstanding, ComReg has considered the potential regulatory options of applying a coverage obligation above 95% population in its updated draft RIA as set out in Annex 9.

7.97 In light of the analysis contained therein, ComReg maintains its preliminary view that Option 3 is the preferred option for existing MNOs and Option 2 is the preferred option for new entrants.

7.98 In light of the above, including that the Connectivity Reports informing the levels of coverage are valid, ComReg also notes the proposed timelines to meet the obligations as set out in Option 3 and Option 2 remain valid.

7.99 Further in relation to Vodafone's query as to whether the incidental coverage is part of the licence conditions. ComReg notes that the obligations for existing MNO's are as set out in Table 17 of Document 19/59R and that Eir and Three

²¹⁶ As identified above, this would be for 50 Mbit/s

²¹⁷ See Annex 4

in their response agree to the associated coverage obligations contained therein. These have been informed in particular by Oxera's modelling in Scenario 2 of Document 18/103c.

Proposed obligations at specific locations

7.100 In relation to Vodafone's and Three's submissions ComReg notes the following:

- the Government's Mobile Phone and Broadband Taskforce (MPBT), has identified a number of actions²¹⁸ aimed at addressing issues related to planning processes and procedures to access infrastructure owned by the state including local authorities;
- in particular those relating to problematic applications, Action 14 is aimed to establish a senior person to take responsibility for engagement with local authorities and that Action 16 is complementary as the County and City Management Association (CCMA)²¹⁹ and Ibec supported by the telecommunications industry are to agree a standardised procedure for seeking planning permission for new mast sites;
- in relation to landlords charging higher rents and the request for flexibility on the being able to provide coverage at these locations, ComReg notes that it does not require that the site is located exactly at the specific location, rather that coverage is provided at the specific location. Therefore, there is flexibility in providing service to the specific locations;

²¹⁸ Including:

Action 7 (OPW, Supported by DRCD, DCCAE, CCMA and the LDA): Commercial and non-commercial state and public bodies to increase the number of records listed on the Intra-State Property Register.7 (Carried forward, with amendments, from 2018 - Actions 18,19 and 20)

Action 11 (CCMA): Increase the number of local authorities providing reasonable access to their facilities to telecommunication companies for the installation of essential infrastructure

Action 13 (CCMA): The LUTs committee, with the engagement of the Irish Public Bodies (IPB), to explore the feasibility of agreeing a prescribed indemnity clause for the use of local authority land and assets by telecoms companies

Action 14: (Ibec supported by Telcos) Telecommunication operators to appoint a senior person to take responsibility for engagement with local authorities as a designated first point of contact for problematic applications.

Action 15: In the context of existing statutory obligations, telecommunication operators to agree on a voluntary Code of Practice for granting/sharing access to mobile telecommunication infrastructure.

Action 16 (Ibec supported by Telco/CCMA): Telecommunication sector to work with local authorities to agree a standardised procedure for seeking planning permission for new mast sites –including: taking account of County Development Plan, preplanning meetings and standardised Application Pack.

²¹⁹ CCMA: The "representative voice" of the local government management network. Its members are Chief Executives of the County and City Councils and the Assistant Chief Executives of Dublin City Council. www.lgma.ie/en/CCMA

and,

- Further, while Vodafone questions whether the specific locations obligations are precautionary, it also identifies that if the other planning and access issues are addressed it would be willing to provide coverage to 100% of the locations within the timeframe proposed.

7.101 ComReg further notes that the proposed obligation to provide coverage at 100% of the specific locations is to be met over a 7 year time period, with interim milestone dates for each category of 70% in 3 years and 90% in 5 years.

7.102 In light of the above, ComReg is of the view that the obligations to provide coverage at specific locations and the necessary flexibility and actions by the competent authorities are in place to address the concerns raised.

7.103 Further, as set out in Annex 10, ComReg sets out further detail on defining the specific locations, which includes identifying the geographic boundaries of each of the locations. ComReg proposes to use the geographic boundaries, as defined in the shapefiles made available on ComReg's webpage²²⁰, to assist with assessing compliance with the obligation.

7.104 In particular, ComReg has further clarified, the obligation relating to the specific locations for the Business and Technology parks. ComReg in Document 19/59R proposed the IDA as being the relevant competent authority to identify the business and technology parks. ComReg notes that absent other official sources on other business and technology parks in the State, the IDA locations are used to identify these locations. ComReg proposes, and as further detailed in Annex 10, to include adjacent business and technology parks to those of the IDA, while aiming to exclude large green areas that have no development.

Proposals in relation to the measuring and monitoring the obligations

7.105 In the main, ComReg notes that the comments received in relation to measuring and monitoring the coverage obligations primarily related to clarifying certain points. In the sections below, ComReg sets out the relevant clarifications and where relevant provides additional information.

Whether all available rights of use can contribute to meeting the obligation and whether carrier aggregation should be used

7.106 ComReg has set out the proposed obligations informed by amongst other things the Connectivity reports. Oxera in its report, in particular, identifies that three band sub 1 GHz carrier aggregation will be very useful to operators targeting

²²⁰ <https://www.comreg.ie/industry/radio-spectrum/spectrum-awards/proposed-multi-band-spectrum-award/>

the extension of 30 Mbit/s SUTP coverage and this is a key factor informing the proposed obligation. Further ComReg in paragraph 8.170 of Document 19/59R. However, ComReg notes that all rights of use can be used to meet the proposed obligations.

Proposals as to the appropriate RSRP level for the different obligations

- 7.107 ComReg notes Oxera's findings that where carrier aggregation is deployed using three sub 1 GHz carriers that the additional bandwidth and resultant throughput gains are available for the whole of the cell range (Figure A.2.5 of Oxera Report Document 18/103c) e.g. 700, 800 and 900 MHz carriers, however ComReg notes that this principle would also apply where other comparable bands are carrier aggregated, e.g. 2.1 GHz, 2.3 GHz and 2.6 GHz.
- 7.108 Where, bands with different propagation characteristics are carrier aggregated, in general the throughput enhancements are achieved over the range of the highest of the frequency bands (Figure A.2.5 of Oxera Report) and as such are more aimed at increasing throughput closer to the site. Therefore in this scenario the throughput enhancements are not achieved across the whole range of the lower frequency cell²²¹.
- 7.109 Informed by the Oxera Report, amongst other things, ComReg intends to establish an obligation that aims to incentivise operators to deploy new sites where appropriate, upgrade sites with additional spectrum, make use of improvements in technology such as new standards including carrier aggregation and carrier sharing or extension techniques.
- 7.110 How the above techniques are deployed on a network will yield varying benefits in terms of increasing the range of a cell for a given throughput, however ComReg envisages that the techniques will be those used to expand throughput coverage.
- 7.111 ComReg proposed in Document 19/59R that it would establish an RSRP base level of -95 dBm as a proxy for a 30 Mbit/s SUTP level for a 10 MHz downlink carrier. Where capacity increasing techniques are used such as carrier aggregation and/or deploying additional bandwidth, a lower RSRP value can be used. ComReg also noted that by carrier aggregating an additional sub 1 GHz carrier of 10 MHz could result in approximately 5 - 10dB lower RSRP when targeting a given throughput.
- 7.112 In light of the above, and noting Vodafone's proposals that -105 dBm is appropriate when band aggregation is used, ComReg is of the view that the

²²¹ Oxera Report Document 18/103C, Annex 2

proposed RSRP level of -95 dBm²²² is appropriate as a proxy for a 30 Mbit/s SUTP for a 10 MHz downlink carrier and this may be lowered to -105 dBm, where three band carrier aggregation is used for bands with comparable propagation characteristics. However as new technologies are rolled out, ComReg would consider proposals from licensees on how this could influence meeting the coverage obligations.

7.113 In a scenario where an existing licensee obtains rights of use for one 2x5MHz lot in the 700 MHz Duplex, ComReg proposed, in Document 19/59R, that the 30 Mbit/s SUTP obligation be reduced to 20 Mbit/s SUTP, while maintaining the same percentage figures for the different obligations. This was informed by the Oxera Report, in particular Figure A2.5, which illustrates that where the bandwidth available reduces, the throughput available at cell edge also reduces.

7.114 Considering this, and for the purposes of measuring and monitoring the coverage obligation, ComReg proposes to apply the same methodology as for the 30 Mbit/s obligation (i.e. -95 dBm for a single carrier of 5 MHz and a reduction by 5dB for each additional carrier), noting that the throughput achievable will be in keeping with the 20 Mbit/s obligation due to the reduced available bandwidth.

7.115 ComReg notes that this will have a number of benefits, in particular:

- it remains consistent with ComReg's intention to establish an obligation that aims to incentivise operators to deploy new sites where appropriate, upgrade sites with additional spectrum, make use of improvements in technology such as new standards including carrier aggregation and carrier sharing or extension techniques; and
- it provides a uniform methodology for assessing compliance with the coverage obligation where three band carrier aggregation is used.

7.116 Regarding an appropriate level for 3 Mbit/s, ComReg notes that Traficom²²³ in its report identify a level of -110 dBm for basic LTE connectivity and Oxera, in Table A2.4 sets out the maximum allowable path loss (MAPL) figures for 3 Mbit/s for a 2x10 MHz carrier at 700 MHz and for adding three sub 1 GHz carrier. By adding the additional carriers increases the MAPL from between 1.7dB to 3.5dB depending on the band;

7.117 Noting the above information and comparing the coverage levels as modelled

²²² Noting that this level could be increased considering Traficom's considerations in its report "Definitions for communications services and networks used in Traficom's statistics and requests for information"

²²³ *ibid*

in the Oxera Report and the Outdoor Coverage Map, ComReg intends to establish a RSRP base level of -110dBm as a proxy for a 3Mbit/s SUTP for a single 2x10 MHz carrier. Where two or three band carrier aggregation is deployed across bands with similar propagation characteristics (e.g. 700 MHz, 800 MHz and 900 MHz carriers) an RSRP level of -112dBm and -114dBm will apply respectively.

- 7.118 In relation to a new entrant obtaining rights of use in the 700 MHz Duplex, ComReg's proposed obligations consist of different SUTP levels (30 Mbit/s, 20 Mbit/s and 10 Mbit/s) depending on the different amount of spectrum rights of use obtained across both the 700 MHz Duplex and other proposed bands. ComReg notes that there may be many different potential combinations of spectrum and deployment techniques that could be used by a new entrant, and ComReg proposes to apply the same principles as identified above in determining the appropriate approach to measuring and monitoring obligations for a new entrant.

Definition of population coverage

- 7.119 For the purposes of measuring and monitoring the population obligation, ComReg's intends to identify the population coverage by using the most up to date and appropriate datasets available at the time of conducting the measurement. While there may be a variety of sources that could provide approximations on a population dataset, ComReg presently intends that the population dataset can be generated by combining information from the CSO and the Eircode datasets.
- 7.120 Presently ComReg intends to use the residential addresses as contained in the Eircode database to determine the geographic coordinates of the residential locations and the population statistics for the small areas dataset as provided by the CSO.
- 7.121 ComReg intends to share with licensees the methodology to use for developing the population file for assessing compliance. However, in the event of any discrepancy, the file used by ComReg would be definitive in assessing compliance with the obligation.

Use of ComReg's network planning tools to assess compliance with coverage obligation

- 7.122 ComReg notes that Vodafone directly supported ComReg's proposal to use network planning tools to assess compliance with the coverage obligations. Vodafone suggested sharing the parameters used to ensure an efficient compliance process.
- 7.123 Three requested information on the percentage coverage probability to be used

in modelling the coverage. ComReg, can confirm that it uses a 75% cell edge coverage probability which equates to 90% overall coverage probability²²⁴.

- 7.124 In relation to other information, in principle ComReg does not see any issue with this, however the core dataset used to predict the coverage as displayed in ComReg's outdoor coverage map is as provided by the operators themselves. The variance between that and an operator's own modelling will be limited to variations in the proprietary propagation models used along with their calibrations and the digital terrain modelling. However if other parameters are deemed to be of value then ComReg will consider whether it's appropriate to share same if requested.
- 7.125 ComReg identified in Document 19/59R that drive test measurements could be used to assess compliance with the measurement for certain metrics, e.g. roads, population or to verify the modelling conducted by ComReg.
- 7.126 In this regard, ComReg can clarify that the network planning tools that generate the outdoor coverage map would be the primary method used to assess compliance with the coverage obligations. Additional measurements which could be gathered via drive testing, or other methods may be used to assist in calibrating the model. In particular for the coverage obligations on roads, the planning tools used to generate the outdoor coverage map would primarily be used. Additional measurements taken by driving certain sections of road may be used as appropriate to assist in assessing compliance in areas that may be difficult to predict, for example where there are cuttings. In each case the RSRP and availability of carrier aggregation would be calculated/measured as appropriate and compared to the relevant obligation.
- 7.127 In summary ComReg proposes to measure and monitor the coverage obligation based on the following principles:
- the ComReg network planning tools, supported by field measurements which may include drive tests where appropriate, would be the key component in assessing compliance with the coverage obligations;
 - that all rights of use available to the licensee can be used to contribute to meeting the coverage obligations;
 - while acknowledging that newer technologies will be rolled out over time, LTE technology is expected to continue to be used by operators in delivering data to consumers for some time and in this regard ComReg proposes to use a RSRP metric for determining the coverage levels;

²²⁴ http://radiomobile.pe1mew.nl/?Calculations:Propagation_calculation:Radio_coverage_probability

- the obligations are set to incentivise operators to rollout new sites as appropriate, upgrade sites with additional spectrum and make use of improvements in technology such as new standards including carrier aggregation and carrier sharing or extension techniques;
- depending how the above techniques are deployed on a network, this will yield varying benefits in terms of increasing the range of a cell for a given throughput;
- where carrier aggregation is deployed using carriers with similar propagation characteristics (e.g. 700, 800 and 900 MHz) that the additional bandwidth and resultant throughput gains will be available, to a large extent, for the whole of the cell range;
- where bands with different propagation characteristics are carrier aggregated, the throughput enhancements will be considered over the range of the highest of the frequency bands;
- a RSRP base level of -95 dBm would be used as a proxy for a 30 Mbit/s SUTP²²⁵ level for a 10 MHz downlink carrier. Where capacity increasing techniques are used such as carrier aggregation and or deploying additional bandwidth, a lower RSRP value can be used;
 - where two or three band carrier aggregation is deployed across bands with similar propagation characteristics (e.g. 700 MHz, 800 MHz and 900 MHz carriers) an RSRP level of -100 dBm and -105 dBm would apply respectively.
- a RSRP base level of -110 dBm would be used as a proxy for a 3 Mbit/s SUTP level for a 10 MHz downlink carrier. Where capacity increasing techniques are used such as carrier aggregation and or deploying additional bandwidth, a lower RSRP value can be used;
 - where two or three band carrier aggregation is deployed across bands with similar propagation characteristics (e.g. 700 MHz, 800 MHz and 900 MHz carriers) an RSRP level of -112 dBm and -114 dBm would apply respectively.
- noting that there may be many different potential combinations of spectrum and deployment techniques that could be used by a new entrant, ComReg proposes to apply the same principles as identified above in determining the

²²⁵ ComReg notes that for the purpose of assessing compliance with the obligation where an existing MNO was to obtain 2x5 MHz in the 700 MHz band (i.e. where the obligation is to provide 20Mbit/s SUTP), ComReg would deploy the same methodology for the 30 Mbit/s case, (i.e. assume a 2x10 MHz carrier is deployed).

appropriate approach to measuring and monitoring the coverage obligations; and

- as new technologies or coverage enhancing techniques are rolled out, ComReg would consider proposals from licensees as to how this could influence meeting the coverage obligations.

7.4.5 ComReg's Updated position

7.128 In light of the above, ComReg's preliminary Decision is to apply the following licence conditions to rights of use in the 700 MHz Duplex:

Existing MNO's

7.129 An existing MNO who wins at least 2×10 MHz of spectrum in the 700 MHz Duplex would need to meet:

- Coverage levels as set out in Table 7 below; and
- Coverage at specific locations as set out in Table 8 below.

Table 7: Obligations on an existing MNO winning at least 2×10 MHz in the 700 MHz Duplex

Outdoor Coverage Service (Single User Throughput Cell Edge)	Coverage dimension	Coverage level to be met in:		
		3 Years	5 Years	7 years
30 Mbit/s	Population	85%	92%	95%
30 Mbit/s	Motorways	75%	85%	90%
30 Mbit/s	Primary Roads	60%	75%	80%
3 Mbit/s	Population	99%	99%	99%
3 Mbit/s	Geographic area	90%	91%	92%

Table 8: Coverage obligations at specific locations

What	Where	When
Outdoors: 30 Mbit/s (Single User Throughput Cell Edge)	<p>Specific locations as set out in Annex 8 which include</p> <ul style="list-style-type: none"> • Business and technology Parks (including strategic sites): The IDA identifies a list of 31 business and technology Parks and 9 Strategic Sites • Hospitals: the Health Service Executive (HSE) identifies a list of the 48 public and 17 private hospitals • Higher Education Campuses: The Higher Education Authority (HEA) identifies a list of 8 Universities, 11 Institutes of Technology and 5 other colleges • Air and Sea Ports: the Department of transport tourism and Sport (DTTAS) identifies a list of the 7 main airports and the Irish Maritime Development Office (IMDO) identify a list of the 7 passenger sea ports. • Train and bus stations: the National transport Authority identifies the busiest 144 train stations and Bus Eireann identifies a list of the main 16 bus stations • Top visitor attraction information points: Failte Ireland identifies a list of the top (21) fee charging and (21) free entry visitor attractions. 	<p>For each category</p> <p>70 % in 3 years</p> <p>90 % in 5 years</p> <p>100 % in 7 years</p>

7.130 For an existing MNO, that wins less than 2×10 MHz of spectrum in the 700 MHz Duplex would need to meet the above obligations, except the minimum single user throughput cell edge level would be 20 Mbit/s.

New entrants

7.131 A new entrant who wins spectrum of at least 2×10 MHz in the 700 MHz Duplex and 2×20 MHz of capacity spectrum or equivalent²²⁶ would need to meet the obligations as set out in Table 9 below.²²⁷

²²⁶ This could also be 40 MHz of TDD spectrum.

²²⁷ This obligation is informed by amongst other things, Oxera's Scenario 8, which models a new entrant obtaining rights of use for 2×10 MHz in the 700 MHz Band along with 2×20 MHz in the 2.6 GHz Band.

Table 9: Obligations on new entrant winning 2×10 MHz in the 700 MHz Duplex and 2×20 MHz of capacity spectrum²²⁸

Outdoor Coverage Service (Single Throughput Edge) User Cell	Coverage dimension	Coverage level to be met		
		4 Years (2024)	6 Years (2027)	10 years (2030)
30 Mbit/s	Population	75%	80%	90%

7.132 For a new entrant who only wins 2×10 MHz or 2×5 MHz in the 700 MHz Duplex would need to meet the above obligation, except the single user throughput cell edge level would be reduced to 20 Mbit/s and 10 Mbit/s respectively. ComReg noted in Document 19/59R that these levels are of course minima and it would be open for any new entrant to advance these levels further as appropriate.

Other related coverage obligations

7.133 ComReg's preliminary Decision is:

- that a coverage obligation should focus on outdoor coverage only; and
- that indoor connectivity is achieved via an obligation on any rights of use obtained via the award process where, if a mobile voice service is provided to a licensee's customers (which would include any provided to third party customers by a licensee, for example in the case of MVNO arrangements) then it must also provide Native Wi-Fi within 2 years of licence commencement.

7.4.6 Performance Bands – Proposed Obligations

7.134 This section considers the proposed Performance Bands obligation. In doing so, ComReg firstly sets out a summary of the proposed obligations from Document 19/59R, a summary of submissions received to Document 19/59R, ComReg's assessment of same and finally ComReg's updated position.

Summary of Proposals as set out in Document 19/59R

7.135 ComReg in Document 19/59R proposed a base station obligation for the proposed bands. Table 10 below sets out the detail of the proposed Performance Bands Obligations related to the preferred option as considered by ComReg in its Draft RIA in Annex 9 of Document 19/59R. Specifically the

²²⁸ Or equivalent: i.e. 40 MHz of TDD spectrum.

proposed base station rollout obligation applicable for in the different scenarios.

Table 10: Summary of proposed base station rollout obligation for the Performance Bands

Service	New Entrant Obligation			Existing Operator ²²⁹ Obligation		
	2.1 GHz	2.3 GHz	2.6 GHz	2.1 GHz	2.3 GHz	2.6 GHz
Mobile	Option 2 (290)	Option 2 (290)	Option 2 (290)	Option 4 (1,200)	Option 3 (550)	Option 3 (550)
Other	Option 2 (80)	Option 2 (80)	Option 2 (80)	Option 2 (290)	Option 2 (290)	Option 2 (290)

7.136 In line with the analysis set out in the draft Rollout RIA in Annex 11 of Document 19/59R, ComReg proposed that the above rollout obligation would be achieved in the period of 3 – 5 years.

7.137 Further, ComReg proposed that:

- a minimum base station capability requirement would apply of 4 bits/Hz²³⁰. This minimum requirement does not prevent equipment which does not meet the minimum capability requirement from being used in the Performance Bands²³¹. However, such equipment would not count towards the rollout obligation or the maintenance of this obligation over the duration of the licence;
- that a compliance reporting mechanism similar to that used for the 3.6 GHz Award would apply; and,
- that base station deployed under a leasing arrangement would count towards achieving the rollout obligation

Base station capability requirements

7.138 In the 3.6 GHz Award a minimum base station capability standard was established that in general terms aimed to encourage licensees to use more

²²⁹ Existing operator refers to the existing licensees in the 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz bands.

²³⁰ 4 bps/Hz is achievable with LTE-A using 16QAM modulation (See section 3.2.1 of Plum Report 3 Document 1575). Other technologies could achieve this throughput rate utilising 64QAM

²³¹ Subject to compliance with all other conditions, including without limitation, BEMs.

efficient equipment and technologies. This element took the form of setting a minimum data throughput capability of any deployed base station that would contribute to the rollout obligation. The 3.6 GHz Award identified a minimum base station capability of 4 bits/Hz²³²

- 7.139 In the interests of continuing to encourage licensees to use efficient equipment and technologies ComReg proposes to again apply a minimum base station capability requirement. Noting that the potential uses of the Performance Bands tend to use equipment with similar technology capabilities which initially may be LTE and may migrate to future 5G deployments, it would therefore seem appropriate to continue to set a minimum base station capability requirement based on the capabilities of an LTE base station, while setting the requirements at a level that would not preclude other technologies.
- 7.140 Noting the above and that equipment is available that can deliver better than 4 bits/Hz, ComReg considers it appropriate to maintain a base station capability requirement of 4 bits/Hz in relation to the base stations that count towards the rollout obligation.
- 7.141 For the avoidance of doubt, the proposed obligation does not prevent equipment which does not meet the minimum capability requirement from being used in the Performance Bands²³³. However, such equipment would not count towards the rollout obligation or the maintenance of this obligation over the duration of the licence.

Summary of submissions received to Document 19/59R

- 7.142 Four respondents (Vodafone, Mr Young, Eir, Three) commented on ComReg's proposed Performance Band rollout obligations
- 7.143 Three respondents (Eir, Three and Mr. Young) agreed with ComReg's proposals, Vodafone disagreed with the proposals and provided alternative suggestions.
- 7.144 While supporting the proposals Eir asked ComReg to clarify what targets were to apply if an operator is using the spectrum for mixed use e.g. mobile in some parts of the country and other elsewhere.
- 7.145 Mr Young, while supporting the proposal noted that the obligations should be sufficiently challenging to deliver maximum coverage.
- 7.146 Three, while assuming that the number of sites to be rolled out as specified in

²³² 4 bps/Hz is achievable with LTE-A using 16QAM modulation (See section 3.2.1 of Plum Report 3 Document 1575). Other technologies could achieve this throughput rate utilising 64QAM.

²³³ Subject to compliance with all other conditions, including without limitation, BEMs.

Table 24 of document 19/59R is for the full duration of the licence it sought that ComReg clarify same.

7.147 Vodafone provides proposals and suggested changes to the obligations, where it:

- (a) Argues that above 1 GHz the bands are not what it considers to be performance bands but rather are used to match capacity with customers so these are best implemented through customer driven processes;
- (b) Contends that as all bands are service and technology neutral the previous justification for separate coverage requirements for 2.1 GHz 3G deployments should no longer apply;
- (c) Believes that the obligations proposed make it inefficient to procure small quantities of spectrum which otherwise might play a useful role for operators in limited locations.
- (d) Argues that the date of support for other bands is uncertain (aside from 2.6 GHz FDD) and thus setting a target in the short term or anything less than 5 years is not appropriate.
- (e) Instead suggests that ComReg sets a condition that compels operators winning spectrum in these other bands to use at least one band on 500 sites within 5 years, which should prevent spectrum hoarding or alternatively use the lower roll out requirements used in 3.6 GHz (131 sites nationwide).
- (f) Vodafone also contends that any coverage obligation should commence post the completion of any transition arrangements.

ComReg's Assessment of submissions

7.148 In relation to Eir's query, if a mobile service is deployed using the rights of use in any part of the country then the mobile base station obligation would apply.

7.149 In relation to Three's query as to whether the obligation is for the whole duration, ComReg can confirm that the obligation is to deploy and maintain the number of base stations for the full duration of the rights of use.

7.150 ComReg addresses each of Vodafone's proposals in turn below.

7.151 **In relation to (a)**, ComReg in Document 19/59R identifies the different use cases for the 2.1 GHz, 2.3 GHz and 2.6 GHz Bands (FDD and TDD). For existing MNO's the bands may be used for capacity enhancements at sites, for fixed wireless access services they may be the only band to provide the full capabilities of the service, in this regard the term performance band is used.

Further ComReg in setting obligations must consider all its statutory objectives including promoting the efficient use of spectrum.

7.152 **In relation to (b)**, ComReg notes that the efficient use of spectrum, promotion of competition and considering the interests of consumers are taken into account in developing proposals. While these considerations are set out in the draft RIA in Annex 11, ComReg considers that the arguments put forward by Vodafone that the obligations should not apply are non-persuasive, in particular

- Vodafone's number of 2.1 GHz sites reduced by just 1 since the publication of 19/59R and overall site numbers currently at 1,504 are over 300 above the proposed obligation. As noted above, this provides sufficient flexibility for Vodafone to further rationalise as may be required.
- Rival operators who both have less market share and in some cases (particularly Eir)²³⁴ a less developed network all acknowledge that the proposed rollout rate is achievable. It seems implausible that the operator with the most subscribers would rollout the Performance Bands (which are used to provide capacity) at significantly lower rates than its rivals.
- Even if Vodafone intended to rollout at lower levels, rival operators with less market share are targeting rollout rates significantly in excess of these levels which would likely incentivise Vodafone to increase its rollout rate in order to maintain its market share.²³⁵

7.153 ComReg is of the view that the likely preferences of each stakeholder group are accurately reflected in the stakeholder assessment above in the draft RIA, and the relevant options are not in excess of what operators would likely deliver commercially in a competitive market.

7.154 **In relation to (c) and (e)**, one of ComReg's key objectives is ensuring the efficient use of radio spectrum. ComReg does not consider Vodafone's argument to be persuasive as an operator obtaining rights of use so that it would deploy it only in limited situations at a minimal number of sites is not in the interests of promoting this objective.

7.155 Further, noting that there are potentially different use cases for the different Performance Bands, and in the interests of promoting the efficient use of each

²³⁴ Eir has less sites and spectrum rights of use than both Three and Vodafone.

²³⁵ For example, Didier Clavero, Vodafone Ireland CTO, recently noted that Vodafone "continually work(s) hard to maintain our position as the leading voice and data mobile provider in the country". <https://n.vodafone.ie/aboutus/press/vodafone-ireland-extends-5g-network-test-bed-as-it-prepares-for-.html>

of the Performance bands, ComReg can clarify that the obligations proposed will apply to each of the bands individually, specifically the 2.1 GHz Band, 2.3 GHz Band, 2.6 GHz Duplex and the 2.6 GHz Duplex Gap. For the avoidance of doubt, if an operator obtain rights of use in the 2.6 GHz Duplex and the 2.6 GHz Duplex Gap, the base stations obligation must be met in each.

- 7.156 **In relation to (d)**, and as identified above, ComReg notes that there are a mix of potential uses for the performance bands, as some of the bands are more established for certain services than others, this may materialise into different valuations for certain bands by certain operators. On balance, ComReg aims to establish a rollout timeframe that would ensure the efficient use of spectrum while also promoting the interests of consumers and promoting competition. This may mean that the proposed obligations may be more challenging to meet in the relevant timeframe for certain deployments than others. However ComReg notes that the equipment ecosystem, as identified in Annex 4, for the Proposed Bands is well established. The TDD bands for mobile deployments are used extensively in other markets and that equipment is available.
- 7.157 ComReg notes that the Oxera Report (Document 18/103c) advised that for an existing MNOs the standard network upgrade could be provided every two days over a 3 year period (i.e. 550 upgrades). This rollout period is sufficient to cover the suggested rollout in Options 1, 2 and 3. Option 4 refers to the 2.1 GHz Band which has already rolled out to these levels.
- 7.158 ComReg proposed rollout obligations across a timeframe of 3-5 years. Vodafone suggested a 5 year timeframe citing that the date of support for some bands (e.g. 2.6 GHz TDD and 2.3 GHz TDD) is uncertain. Other respondents did not comment on the range provided.
- 7.159 Considering the above, ComReg considers that while it may be appropriate to set the obligation for 3 years for existing operators that, due to arguments of uncertainty of equipment as presented by Vodafone that a somewhat longer duration may be more appropriate. In light of the above, ComReg proposes that the rollout obligations for existing operators must be met within 4 years.
- 7.160 Considering the challenges that may be present for a new entrant, including site acquisition, ComReg proposes to set the obligation at 5 years.
- 7.161 **In relation to (f)**, ComReg notes that the obligation will apply from when the lots commence. This is consistent with the approach in the 3.6 GHz Band.

ComReg's Updated position

- 7.162 In light of the above, ComReg's preliminary Decision on the appropriate rollout obligation is that:

- the obligation applies to each of the Performance Bands, specifically the 2.1 GHz Band, 2.3 GHz Band, 2.6 GHz FDD Band and the 2.6 GHz TDD Band;
- Existing Operators must deploy and maintain the appropriate number of base stations within 4 years as set out in Table 11 below;
- New Entrants must deploy and maintain the appropriate number of base station within 5 years as set out in Table 11 below;
- a minimum base station capability requirement of 4 bits/Hz²³⁶ applies for a base station to count towards this obligation.
- a compliance reporting mechanism similar to that used for the 3.6 GHz Award will apply; and
- base stations deployed under a leasing arrangement will count towards achieving the rollout obligation.

Table 11: Base station Rollout obligation for the Performance Bands

Service	New Entrant Obligation				Existing Operator ²³⁷ Obligation			
	2.1 GHz	2.3 GHz	2.6 GHz FDD	2.6 GHz TDD	2.1 GHz	2.3 GHz	2.6 GHz FDD	2.6 GHz TDD
Time	5 Years				4 Years			
Mobile	Option 2 (290)	Option 2 (290)	Option 2 (290)	Option 3 (290)	Option 4 (1,200)	Option 3 (550)	Option 3 (550)	Option 3 (550)
Other	Option 2 (80)	Option 2 (80)	Option 2 (80)	Option 2 (80)	Option 2 (290)	Option 2 (290)	Option 2 (290)	Option 2 (290)

7.4.7 Other obligations

7.163 In Document 19/59R ComReg proposed other obligations related to Native Wi-Fi and VoLTE.

²³⁶ 4 bps/Hz is achievable with LTE-A using 16QAM modulation (See section 3.2.1 of Plum Report 3 Document 1575). Other technologies could achieve this throughput rate utilising 64QAM

²³⁷ Existing operator refers to the existing licensees in the 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz bands.

7.164 ComReg notes that the proposals in relation to Native Wi-Fi have been considered in section 7.4.4 above.

7.165 In relation to VoLTE this matter is considered further in Section 7.5 below under quality of service.

7.4.8 Precautionary and interventionist coverage obligations

Summary of ComReg's View in Document 19/59R

7.166 In Document 19/59R, ComReg in considering coverage obligations for the 700 MHz Duplex, was informed by amongst other things the DotEcon Connectivity Report (Document 18/103d) and considered various options, including the use of 'precautionary' and 'interventionist' coverage obligations²³⁸ where:

- 'precautionary' coverage obligations refer to obligations which do not exceed the levels of coverage that might be expected anyway from well-functioning competition between network operators; and
- 'interventionist' coverage obligations refer to obligations that can be expected to constrain the commercial choices of network operators and force coverage in excess of competitively-determined levels.

7.167 ComReg's approach in Document 19/59R was to set coverage obligations which are precautionary in nature, and are towards the upper end of the range of commercially realistic competitive outcomes. ComReg noted that among other things, this would encourage competition in the award process, thereby underpinning the role of competition in driving coverage, and avoid outcomes where spectrum rights may be unassigned because the coverage obligation was excessive.

7.168 ComReg set out comprehensive proposals in relation to precautionary coverage obligations in Document 19/59R however noted that there may be broader social reasons that would support 'interventionist' coverage obligations to secure more extensive coverage outcomes than would result from marketplace competition alone and observed that such an approach would need to be carefully designed, and based on an assessment of the costs and benefits to society of the additional coverage sought.

7.169 ComReg further observed that 'interventionist' obligations are ideally achieved via a sequential step in a spectrum award or through a separate process. Where such mechanisms may provide advantages for the State in ensuring that the societal benefits obtained exceed the costs of any such obligations. The use of a separate step would also allow policy makers the ability to identify what

²³⁸ See further in ComReg Document 18/103d

'precautionary' coverage obligations and competition between network operators would first deliver, retaining the ability for more targeted interventions later if necessary.

Summary of submissions received to Document 19/59R

- 7.170 Two respondents (Three and Mr. Young) provided comment in relation to interventionist obligations.
- 7.171 Three noted that it is aware that even with the precautionary obligations that there may still be some locations where it is desirable to improve coverage but not viable under normal circumstances. Three noted ComReg's observations that interventionist obligations could be achieved via a sequential step or separate process noting that such mechanisms may provide advantages for the State in ensuring that the societal benefits obtained exceed the costs of any such obligations.
- 7.172 It added that this could be achieved via a reverse auction using a second price sealed bid auction, noting that this could have advantages to create a straightforward value based bidding. It also noted that this could be flexible format to facilitate an innovative way of dividing coverage obligations across operators.
- 7.173 Mr. Young suggests that the interests of Irish consumers, taxpayers and in particular, rural mobile broadband (MBB) users are best served by the adoption of an interventionist approach to coverage obligations, rather than the precautionary approach favoured by ComReg in its consultation document, as the rapid roll out of advanced mobile services to rural communities (before or at the same time as urban ones) would in his view be socially beneficial and improve national competitiveness by ensuring Irish businesses and consumers enjoy the benefits of connectivity at least as quickly as those in other countries.
- 7.174 In addition, Mr. Young submits that an interventionist approach to download speeds and coverage obligations is considered by many regulators to be critical to ensuring that licence holders roll out services quickly, and that radio frequency spectrum is used efficiently and to the maximum benefit of users.

ComReg's assessment of submissions received

- 7.175 In relation to Mr. Young's submission ComReg notes that in summary his proposal is to set obligations that are beyond precautionary or market driven levels and bundle them with an award of rights of use in the Proposed Award. Mr. Young's proposals and his supporting views are considered by DotEcon in Document 19/124b and by ComReg in Section 7.4.4 and Annex 3.
- 7.176 ComReg notes Three's submission and proposals in relation to an approach for

procuring additional coverage beyond what would occur under normal conditions and that its view is broadly in line with that proposed by ComReg.

7.177 ComReg has carefully considered the respondent's views and the assessment of those views by DotEcon, where among other things, DotEcon notes that:

- an efficient outcome for spectrum assignment and use is not the same as simply maximising benefits (which Mr Young appears to consider as greater network coverage and speed) for mobile users, as suggested by Mr Young, without regard to the costs of delivering that outcome; and
- no additional evidence or arguments have been supplied to undermine this conclusion set out in the DotEcon Connectivity Report.

7.178 Noting the assessment set out in Document 19/124b, ComReg is also of the view that no additional points have been raised that would require DotEcon to amend or reconsider the conclusions of its original DotEcon Connectivity Report.

7.179 Finally, ComReg is of the view that what constitutes maximising benefits for consumers is not simply maximising coverage and speed, without regard to the cost to consumers. Indeed, in the extreme, if ComReg mandated sufficiently high speeds and geographic coverage, there would be a crossover point where a greater number of consumers would not be able to afford the charges that operators would have to impose than would gain access as a result of increasing coverage.²³⁹ This would clearly not optimise consumer welfare. Accordingly, a somewhat holistic view needs to be taken to deliver good connectivity and speed at a price level that consumers are willing to pay.

ComReg's Updated Position

7.180 ComReg proposes in its draft decision an extensive set of precautionary coverage obligations and other obligations to be met over a seven (7) year time period from the licence commencement.

7.181 The proposed obligations for an existing MNO include obligations to²⁴⁰:

- deploy and maintain VoLTE and Native Wifi Technology on its network to improve the coverage and quality of voice and text services as appropriate and make it available to consumers under certain conditions within 2 years;

²³⁹ In particular, ComReg notes that consumers appear to have a low willingness to pay for additional coverage, see ComReg Document 19/101, "Mobile Consumer Experience survey 2019", published 18 November 2019, and ComReg Document 17/100a, "Mobile Consumer Experience survey" published 6 December 2017.

²⁴⁰ All throughput obligations relate to a single user throughput cell edge requirement (SUTP)

- provide and maintain
 - 30 Mbit/s outdoor coverage to 95% of the population in 7 years, with milestone obligations of 92% in 5 years and 85% in 3 years;
 - 30 Mbit/s outdoor coverage to 90% of the motorway network in 7 years with milestone obligations of 85% in 5 years and 75% in 3 years;
 - 30 Mbit/s outdoor coverage to 80% of the primary road network in 7 years with milestone obligations of 75% in 5 years and 60% in 3 years;
 - 3 Mbit/s outdoor coverage to 99% of the population in 3 years;
 - 3 Mbit/s outdoor coverage to 92% of the geographic area of the state in 7 years with milestone obligations of 91% in 5 years and 90% in 3 years;
 - 30 Mbit/s outdoor coverage to 345 specific locations, including, 65 hospitals, 24 higher education campuses, 40 industrial areas, 14 air and sea ports, 160 train and bus stations and 42 top visitor attractions information points. 100% coverage of each category in 7 years, with milestone obligations of 90% in 5 years and 70% in 3 years;

7.182 Further, should an existing mobile operator obtain rights of use in the 2.1 GHz, 2.3 GHz, 2.6 GHz Duplex or 2.6 GHz Duplex Gap, it must deploy and maintain 1,200 base stations in the 2.1 GHz Band and 550 bases stations in the other bands across the country within four years.

7.183 These proposed obligations will oblige existing mobile network operators to improve mobile coverage to levels towards the upper end of the range of commercially realistic competitive outcomes. Competition may also drive coverage beyond these levels, and the setting of precautionary coverage obligations as outlined above will, among other things, encourage competition in the award process, thereby underpinning the role of competition in driving coverage. This should also avoid outcomes where spectrum rights may be unassigned because the coverage obligation was excessive.

7.184 Noting the above and having regard to, among other things, the limited submissions received in support of the inclusion of a mechanism in the Proposed Award by which to procure coverage outcomes beyond market-driven levels and mindful of the timing obligations, and clear benefits of a prompt award of rights of use in the 700 MHz Duplex (along with the spectrum efficiency and related consumer benefits from the earlier award of rights of use in the other Proposed Bands), ComReg intends to advance the Proposed Award targeting the imposition of precautionary coverage and other obligations as summarised

above and as set out in sections 7.4.5, 7.4.6 and 7.4.7.

7.185 ComReg nevertheless remains prepared to assist the State in any subsequent step it may wish to pursue by which to procure coverage outcomes beyond market-driven levels, noting the advantages of a separate step previously identified by ComReg including:

- seeing what the proposed precautionary obligations and competition between operators would first deliver; and,
- thereby better ensuring that the societal benefits obtained from any intervention exceed the costs of imposing same.

7.5 Quality of service obligations

7.5.1 Introduction

7.186 In section 8.5 of Document 19/59R, ComReg proposed the inclusion of Quality of Service (QoS) conditions, consisting of network availability and voice call standard obligations, which would be consistent with the approach taken in the 3.6 GHz Award and 2012 MBSA.

7.187 Additionally, in section 8.4 of Document 19/59R (Coverage and Rollout Obligations), ComReg proposed to include an obligation aimed at improving the quality of voice calls provided to consumers via the deployment of VoLTE technology.

7.188 Consequently, it is appropriate to consider such a VoLTE obligation in the context of QoS obligations for Voice Call Services, which are discussed below in this section.

7.189 In light of the above, this section sets out the following in relation to its proposals for Network Availability, Voice Call Standards and VoLTE Obligations:

- summaries of ComReg's proposals in 19/59R;
- views of respondents to Document 19/59R;
- updated information;
- ComReg's assessment of respondents' views in relation to same; and
- ComReg's updated position.

7.5.2 Summary of ComReg's view in Document 19/59R

Network Availability

7.190 Noting the analysis of the draft 'Network Availability' RIA²⁴¹, ComReg considered that the network availability obligation would protect end users against unreasonable levels of disruption to their service and safeguard the interests of consumers against operators who might otherwise have unacceptably high levels of network unavailability. ComReg proposed that the obligation would apply to all wireless service providers in the Proposed Bands with the following conditions:

- each licensee is to keep a log of network availability, available for inspection by ComReg;
- each licensee is to ensure that network unavailability is less than 35 minutes per six month period; and
- the calculation of network unavailability will be subject to weighting factors²⁴² that take account of traffic load variations.

7.191 In addition, all relevant services provided to a licensee's customers and provided to third party customers (e.g. MVNOs) by a licensee would be captured under this QoS obligation which would be assessed against the aggregate total.

Voice Call Standards

7.192 Noting the analysis of the draft 'Voice Call Services' RIA²⁴³, ComReg proposed to attach similar QoS standards for voice calls to those applied in the 3.6 GHz Award in order to safeguard the interests of consumers against operators who might not otherwise maintain acceptable quality levels for voice calls in line with current expectations.

7.193 Specifically ComReg proposed that each licensee, if providing voice services, would ensure that for each six month period:

- the maximum Permissible Blocking Rates are not exceeded;
- the maximum Permissible Dropped Call Rates are not exceeded; and

²⁴¹ As set out in Annex 10 of Document 19/59R.

²⁴² As set out in paragraph 8.238 of Document 19/59R.

²⁴³ As set out in Annex 10 of Document 19/59R.

- the speech transmission quality meets or exceeds the appropriate standard.

7.194 ComReg also proposed that all relevant 'Managed' voice call services²⁴⁴, provided to customers and third party customers by a licensee would be captured under this QoS obligation. ComReg did not consider including 'unmanaged' voice call services²⁴⁵ in this proposed licence condition.

7.195 ComReg also proposed that any assessment of this obligation would be made against the aggregate total.

VoLTE

7.196 In the context of coverage and rollout obligations, ComReg noted in section 8.4 of Document 19/59R that:

- the 700 MHz EC Decision identifies the importance of the 700 MHz Band for the provision of data services to meet the increasing demand for wireless data and that the band is a valuable asset for deploying cost efficient terrestrial wireless networks with high capacity coverage;
- while voice calls remain an important use for consumers, networks are moving to provide voice services over data in the future (e.g. VoLTE);
- while investments in 2G and 3G networks have matured, any additional investments are likely to be targeted at 4G/5G networks. Considering this, investments in 2G and 3G technologies to improve voice services would likely be inefficient given operators are likely to begin transitioning to 4G/5G networks over time; and
- further any obligation to improve voice services over 2G/3G networks would not likely be proportionate given the availability of alternative more efficient measures to achieve the same ends (e.g. VoLTE).

7.197 Considering the above, ComReg was of the preliminary view that in order to be effective, any proposed coverage obligation would need to apply to data services.

7.198 Additionally, in section 8.4 of Document 19/59R, ComReg proposed that a

²⁴⁴ Including traditional voice call services carried over circuit-switched connections and the 'managed' packet-switched voice call services (e.g. using VOIP or similar protocols) which can be provided over different technologies (e.g. VoLTE, Native Wi-Fi, etc.).

²⁴⁵ 'Unmanaged' voice call services are provided over the applications and/or networks of third parties which the licensee would have very limited control over the quality of the service experienced by the end user e.g. over the top (OTT) applications which are delivered in best effort manner through the Internet access service (i.e. with no prioritisation).

condition of the rights of use issued on foot of the Proposed Award should be that if the rights holder has deployed LTE and a mobile voice service is offered on its network to a licensee's customers (which would include any provided to third party customers by a licensee, for example in the case of MVNO arrangements) then it must also provide VoLTE across all sites within 2 years of licence commencement and that 50% of the sites should be met within 1 year.

7.199 In that regard, ComReg noted that Vodafone had launched VoLTE on its network offering it to customers with compatible handsets²⁴⁶ after trials which started in 2017 and that Eir had announced that VoLTE services will be rolled out over the next two years^{247, 248}. ComReg noted that VoLTE should improve consumers mobile voice experience in a number of ways:

- faster call connection than GSM or UMTS;
- higher quality calls through enhanced HD voice;
- improved voice quality over narrowband and HD voice services on existing 2G and 3G networks;
- flexibility for subscribers to make calls and use 4G data services simultaneously without compromising 4G data connectivity speed; and
- the wide variety of handsets supporting VoLTE.

7.200 Additionally, ComReg noted the likely benefits of VoLTE for MNOs, such as:

- release of additional spectrum for LTE services after transition from 2G/3G services;
- greater spectral efficiency and capacity compared to circuit-switched calls over legacy 2G and 3G networks; and
- operational savings for operators as voice and data can be run across the same infrastructure compared to having one for data and one for voice.

7.5.3 Views of respondents to Document 19/59R

7.201 ComReg did not receive any responses in relation to its network availability

²⁴⁶ <https://www.siliconrepublic.com/comms/volte-vodafone-voice-over-4g-wi-fi-5g>

²⁴⁷ <https://www.siliconrepublic.com/comms/huawei-eir>

²⁴⁸ <https://www.eir.ie/mobilenetworkupgrade/>

proposal.

7.202 Eir stated that it did not disagree with attaching similar QoS standards for voice calls that apply in the 3.6 GHz Band but sought greater specificity before it could 'agree'.

7.203 ComReg received responses from Eir, Three and Vodafone in relation to its proposal for a VoLTE obligation. While Vodafone considered ComReg's VoLTE proposal to be appropriate and useful to promote the best service to customers, Eir and Three disagreed with the proposal.

7.204 Eir considered VoLTE to be a competitive differentiator and contended that:

- it is not ComReg's role to eliminate competitive differentiation; and
- Condition 1 of Part B of the Schedule to the Authorisation Regulations²⁴⁹ may give ComReg authority to impose a VoLTE obligation but only in respect of the frequencies for which the right of use applies.

7.205 Three argued that a VoLTE obligation:

- contradicts ComReg's normal 'technology neutrality' approach;
- might impede a new bidder who wishes to provide data services only; and
- might affect how an existing licensee would wish to use the band, for example only using the incremental spectrum to provide additional data capacity, while maintaining voice service on other technologies.

7.206 Additionally, Three contended that ComReg should let licensees decide whether or when to introduce VoLTE and that all licensees who provide voice services will eventually introduce the technology when they are sure that it provides a customer experience as good as circuit-switched voice, which, in Three's view, is not the case at present.

7.5.4 Updated Information

7.207 As noted above, ComReg has updated its draft 'Voice Call Services' RIA to

²⁴⁹ Part B of the Authorisation Regulations includes (as Condition 1 thereof) the following condition which may be attached to rights of use:

- Obligation to provide a service or to use a type of technology for which the rights of use for the frequency has been granted including, where appropriate, coverage and quality requirements.

include an additional option for a VoLTE obligation.

7.208 In the updated draft 'Voice Call Services' RIA, as set out in Annex 12, ComReg has identified and considered the following options for meeting the most relevant objectives in terms of QoS for Voice Call Services²⁵⁰:

- **Option 1:** Do not impose QoS licence conditions on 'managed' voice call services, provided using the 700 MHz Duplex, the 2.1 GHz Band, the 2.3 GHz Band, and the 2.6 GHz Band.
- **Option 2:** Impose QoS conditions on 'managed' voice call services, provided using the 700 MHz Duplex, the 2.1 GHz Band, the 2.3 GHz Band, and the 2.6 GHz Band.
 - *Option 2A:* Impose such QoS conditions in line with licence condition in the 3.6 GHz Band Liberalised Use Licences²⁵¹.
 - *Option 2B:* Impose such QoS conditions in line with the licence condition in the 3.6 GHz Band Liberalised Use Licences²⁵² and additionally include an obligation that where LTE is deployed in the Proposed Bands, and where consumers using the Proposed Bands are also offered a mobile voice service, VoLTE technology must be enabled on the licensee's network and the base stations in the Proposed Bands and made available to consumers (including MVNO consumers) that have a VoLTE enabled handset within an appropriate period.

7.209 For the reasons identified in the updated draft 'Voice Call Services' RIA, ComReg's preliminary view is that Option 2B is the preferred option in terms of the imposition of a 'managed 'voice call' QoS licence condition. In that regard, the updated draft 'Voice Call Services' RIA identifies a number of potential benefits of such an obligation for stakeholders (i.e. MNOs, New Entrants and MVNOs), competition and consumers, several of which are outlined below.

Impact on stakeholders

7.210 The benefits of a VoLTE obligation for stakeholders, as identified in the RIA, include that:

- VoLTE provides greater spectral efficiency and capacity gains

²⁵⁰ I.e. to ensure that all users derive maximum benefit in terms of price, choice and quality from the spectrum to be made available in the Proposed Award.

²⁵¹ See [S.I. No. 532/2016](#) - Wireless Telegraphy (3.6 GHz Band Licences) Regulations 2016.

²⁵² See [S.I. No. 532/2016](#) - Wireless Telegraphy (3.6 GHz Band Licences) Regulations 2016.

compared with conventional circuit-switched calls over legacy 2G and 3G networks²⁵³;

- VoLTE can provide operational savings for operators as it can run voice and data services across the same infrastructure compared to having one for packet-switched data and one for circuit-switched voice;
- a new entrant would more likely rollout VoLTE rather than a 2G/3G network to provide voice services; and
- an MVNO would likely prefer a VoLTE obligation as it would maximise the amount of services that would be available to consumers.

Impact on competition

7.211 Potential benefits of a VoLTE obligation for competition, as identified in the draft RIA, include that:

- such a measure would provide greater protections against distortions or restrictions of competition; which might arise if one or more operators failed to rollout VoLTE, having already rolled out an LTE network;
- the proposed obligation would provide protection that VoLTE would be provided by all operators and would encourage timely rollout of VoLTE, thus promoting competition and maximising benefits for consumers;
- the proposed obligation would reassure network operators that they will not face the risk of one or more operators compromising the ability of the market to deliver consumer benefits across the entire market. This would encourage efficient investment in enhanced infrastructure, promoting innovation and ensuring the efficient use and effective management of the radio frequency spectrum; and
- VoLTE optimises the spectral efficiency of mobile voice using LTE and delivers voice calls three times more efficiently for the same quality of voice call. This would promote competition by facilitating spectrum re-farming and making available more spectrum resources for the provision of high growth services (i.e. data).

Impact on consumers

7.212 Potential benefits of a VoLTE obligation for consumers, as identified in the

²⁵³ In that regard, ComReg notes that VoLTE can support up to twice as many voice users in a given bandwidth (per megahertz) compared to conventional circuit-switched 2G and 3G networks. <https://www2.deloitte.com/ie/en/pages/technology-media-and-telecommunications/articles/tmt-pred16-telecomm-volte-vowifi-capacity-reach-capability.html>

draft RIA, include that:

- VoLTE offers better voice quality compared to OTT and circuit-switched calls and quicker call set-up times compared to 3G; and
- the benefits for consumers of VoLTE would not be fully realised unless all MNOs transition to VoLTE where both ends of a call between two different networks can be delivered through LTE.
- due to the spectrum efficiency gains, consumers will be able to avail of better/ faster services from the networks.

7.5.5 ComReg's assessment of respondents' views

7.213 ComReg notes that no respondents disagreed with its proposals in relation to network availability. In that regard, and given that ComReg's draft 'Network Availability' RIA, as set out in Annex 12, remains substantially unchanged from Document 19/59R, ComReg sees no reason to amend its network availability proposal.

7.214 Additionally, ComReg notes that no respondents disagreed with its proposals in relation to voice call standards. However, in response to Eir's request for greater specificity on the QoS standards for Voice calls that would apply in the Proposed Bands, ComReg can clarify that it proposes the same QoS standards for voice calls as those applied in the 3.6 GHz Award²⁵⁴.

7.215 ComReg notes that Section 7.4.3, specifically under the sub-heading of "*Proposals that an obligation should focus on outdoor coverage and that a Native Wi-Fi obligation should apply to address indoor coverage*" provides relevant background information and assessment informing both ComReg's proposals for a Native Wi-Fi and VoLTE obligation.

7.216 In relation to Eir's view that VoLTE is a competitive differentiator and that ComReg has no role in eliminating such differentiation, ComReg would point out that its proposal is not to eliminate competitive differentiation, but rather to maximise benefits to consumers by appropriately and proportionately addressing evidenced consumer issues (i.e. poor voice coverage and quality per ComReg's 2019 Mobile Phone Consumer Experience Survey) for clearly important consumer services that should be addressed in a well-functioning competitive market over an appropriate period. The potential benefits of a VoLTE obligation for competition are identified in the updated draft 'Voice Call Services' RIA, several of which are noted above. In particular, ComReg would highlight its observation in the RIA that the full benefits of VoLTE (for

²⁵⁴ I.e. The same minimum voice call standards set out in Part 4, Section 5 of the 3.6 GHz Band Liberalised Use Licence.

competition and consumers) would not be provided unless both ends of the call are delivered through LTE.

7.217 Further, the contention that VoLTE is a competitive differentiator is not convincing considering the assessment in the draft RIA and also noting that:

- Vodafone has already²⁵⁵ rolled out VoLTE across its network; and,
- Eir intends²⁵⁶ to do so as part of its wider network rollout over the next 2 years²⁵⁷.
- Three has indicated that it will deploy this technology.

7.218 ComReg notes Eir's observation that Condition 1 of Part B of the Schedule to the Authorisation Regulations may give ComReg authority to impose a VoLTE obligation but only in respect of the frequencies for which the right of use applies. In that regard, ComReg notes that its proposal in Section 8.4 of Document 19/59R was for a VoLTE obligation as a condition of the rights of use issued on foot of the Proposed Award, i.e. for an obligation to apply to right of use for the Proposed Bands.

7.219 Considering Three's response, ComReg does not accept Three's submission that the proposed VoLTE obligation contradicts ComReg's normal 'technology neutrality' approach.

7.220 Firstly, ComReg notes, as indicated above, that service and technology neutrality is the principle that spectrum rights of use, and the conditions applied thereto, should not preclude the provision of any specific service and/or the use of any technology. Secondly, ComReg observes that, in mandating VoLTE where a mobile operator has deployed LTE in the Proposed Bands, ComReg would not be precluding operators from providing other services and/or technologies in those bands that comply with the relevant EC/CEPT harmonisation decisions for the Proposed Bands.

7.221 In any case, ComReg notes that Condition 1 of Part B of the Schedule to the Authorisation Regulations²⁵⁸ gives ComReg authority to attach to any rights of

i.e. The same minimum voice call standards set out in Part 4, Section 5 of the 3.6 GHz Band Liberalised Use Licence.

²⁵⁵ <https://www.independent.ie/business/technology/vodafone-switches-on-volte-service-on-its-network-35973395.html>

²⁵⁶ <https://www.siliconrepublic.com/comms/huawei-eir>

²⁵⁷ <https://www.eir.ie/mobilenetworkupgrade/>

²⁵⁸ Part B of the Authorisation Regulations includes (as Condition 1 thereof) the following condition which may be attached to rights of use:

use, as may be issued on foot of the Proposed Award, obligations to provide a service or to use a type of technology, including, where appropriate, coverage and quality requirements in accordance with Condition 1 of Part B of the Schedule to the Authorisation Regulations.

7.222 In arguing that ComReg's proposed VoLTE obligation might impede a new bidder who wishes to provide data services only, Three does not appear to have considered that ComReg's proposed VoLTE obligation in Document 19/59R would only apply to a licensee which (a) has deployed LTE and (b) offers a mobile voice service on its network to its customers. In that regard, ComReg recalls that its proposal as set out in paragraph 8.98 of Document 19/59R was for:

*"...a condition on any rights of use issued on foot of the Proposed Award to be that **if the rights holder has deployed LTE and a mobile voice service is offered on its network to a licensee's customers** (which would include any provided to third party customers by a licensee, for example in the case of MVNO arrangements) then it must also provide VoLTE." (**emphasis added**)*

7.223 Clearly, such an obligation would not apply to a new entrant offering only data services, whether by means of LTE or any other appropriate technology.

7.224 ComReg notes Three's point that a VoLTE obligation would affect how an existing licensee would wish to use the band, for example only using the incremental spectrum to provide additional data capacity, while maintaining voice service on other technologies.

7.225 First, in response to Three's point, ComReg notes that it set out its proposal in Section 8.4 of Document 19/59R for a VoLTE obligation noting the following:

- ComReg noted the results of its 2017 Mobile Consumer Experience Survey²⁵⁹ which indicated, among other things, that the main service issues outdoors all related to voice calls rather than data usage. The results of ComReg's most recent 2019 Mobile Consumer Experience Survey²⁶⁰, as discussed in the updated draft 'Voice Call Services' RIA, show that this continues to be the case.
- ComReg also observed in section 8.4 of Document 19/59R that the outdoor population coverage options considered in that document would provide

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- Obligation to provide a service or to use a type of technology for which the rights of use for the frequency has been granted including, where appropriate, coverage and quality requirements.

²⁵⁹ 'Mobile Consumer Experience Survey', ComReg Document 17/100a.

²⁶⁰ ComReg's 2019 Mobile Consumer Experience Survey.

for voice coverage. However, ComReg further noted that, because voice services are currently provided over GSM and UMTS (i.e. 2G and 3G networks) it is not clear whether a population coverage obligation at a rate of 30 Mbit/s would necessarily improve the quality of service for voice calls to any material degree.

- further, in section 8.4 of Document 19/59R, ComReg considered the potential benefits of VoLTE for consumers, including support of higher quality calls by providing enhanced HD voice services improving the quality of voice calls beyond the narrowband voice and HD voice services currently deployed on existing 2G and 3G networks.

7.226 Second, as stated in Section 8.4 of Document 19/59R, ComReg considers that such a condition is justified and proportionate for reasons including that it would:

- better facilitate the rollout of VoLTE in an efficient manner, which should contribute to users deriving maximum benefit in terms of choice, price and quality²⁶¹;
- encourage the efficient use of the radio spectrum and avoid inefficient investment costs in 2G/3G technologies that will likely be decommissioned over a period of time;
- would promote efficient investment and innovation in new and enhanced infrastructures by encouraging the rollout of VoLTE;
- be proportionate because, among other things:
 - the objective of the obligation (i.e. improve voice QoS in a manner which would avoid inefficient investment costs) would accord with ComReg's statutory objectives and regulatory principles as described above;
 - there do not appear to be less onerous means by which improved voice services could be achieved;
- accord with the principle of safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure-based competition; and
- provide winning bidders with 2 years to deploy VoLTE, reflecting that this needs to be carefully deployed and made available to consumers in an

²⁶¹ In that regard, ComReg notes Vodafone's support for ComReg's VoLTE obligation proposal, which Vodafone considers to be to be appropriate and useful to promote the best service to customers.

orderly way which in ComReg's view provides sufficient time for appropriate testing and validation.

7.227 Third, ComReg's updated draft 'Voice Call Services' RIA, on balance, favours the inclusion of such an obligation, having considered the regulatory options for meeting the most relevant objectives in terms of QoS for Voice Call Services, in view of the potential impact of those options on stakeholders²⁶², competition²⁶³ and consumers.

7.228 Fourth, in view of ComReg's proposal to also apply a Native Wi-Fi obligation to any rights of use in the Proposed Bands where a mobile voice service is provided, ComReg notes the synergy between the deployment of VoLTE and Native Wi-Fi, as both use the same underlying SIP/IMS technology.

7.229 Finally, ComReg does not agree with Three's contention that licensees providing mobile voice services should be permitted to decide to introduce VoLTE if and when they are sure that it provides a customer experience as good as circuit-switched voice, which, in Three's view, is not the case at present. In that regard, ComReg notes the reasons identified above which favour applying a VoLTE obligation and further notes that relevant mobile industry publications indicate significant improved customer experience resulting from VoLTE compared to circuit switched voice, in that VoLTE offers:

- the best voice quality compared to OTT and circuit-switched voice calls. LTE with a speech rate of 12.65 kbps falls within the range of 'good quality' specified in ITU-T P.863. On the other hand 3G and OTT falls within the range of 'Acceptable Quality' while 2G falls in to 'poor quality'.²⁶⁴
- quicker call set-up times (0.9 – 2.2 seconds) compared to 3G circuit-switched networks (4 – 6 seconds).²⁶⁵

7.230 Accordingly, having considered respondents' views on the matter, ComReg remains of the view that it is appropriate to apply a VoLTE obligation to any rights of use in the Proposed Bands, noting that it has provided further specificity on the proposed obligation as set out in section 7.5.6 below and in the draft RIA. Additionally, for the reasons identified in the updated draft 'Voice Call Services' RIA, ComReg's preliminary view is that such an obligation should be included with QoS conditions for Voice Call Services under licences

²⁶² MNOs, new entrants and MVNOs.

²⁶³ Distortions to competition, consumer benefits and efficient use of the radio spectrum.

²⁶⁴ Einashar, A & A. El-Saidny, M (2018), 'Practical Guide to LTE-A, VoLTE and IoT: Paving the way towards 5G: 1st Edition' Wiley, p212 – 213.

²⁶⁵ Holma, H, Toskalka, A & Reunanen (2016) 'LTE Small Cell Optimization: 3GPP Evolution to Release 13' John Wiley and Sons, p 404.

to be issued in respect of the Proposed Bands.

7.5.6 ComReg's updated position

7.231 In light of the above, ComReg has updated its position in relation to minimum QoS licence obligations for voice call standards which it proposes to apply in respect of any rights of use issued on foot of the Proposed Award. In that connection, ComReg is now of the preliminary view that it is appropriate to:

- impose QoS conditions on 'managed' voice call services, provided using the 700 MHz Duplex, the 2.1 GHz Band, the 2.3 GHz Band, and the 2.6 GHz Band;
- impose such QoS conditions in line with the licence condition in the 3.6 GHz Band Liberalised Use Licences²⁶⁶; and,
- if LTE is deployed in the Proposed Bands, and where consumers using the Proposed Bands are also offered a mobile voice service, VoLTE technology must be enabled on the licensee's network and the base stations in the Proposed Bands and made available to consumers (including MVNO consumers) that have a VoLTE enabled handset. This obligation is to deploy and maintain VoLTE across all LTE base stations within 2 years and that 50% of LTE base stations should be enabled within 1 year.

7.6 The notification of the termination of a technology

7.6.1 Summary of ComReg's view in Document 19/59R

7.232 In Section 8.6 of Document 19/59R, ComReg set out its preliminary view that it would be appropriate to attach a licence condition requiring notification of the termination of a technology to spectrum rights in the Proposed Bands, given the potential for "consumer disruption" issues, noting also that the cessation of a technology is not currently within the scope of the consumer protection provisions of Condition 18 of the General Authorisation. In the interests of regulatory consistency, the licence condition would be on substantively the same terms as that imposed previously for licences in the 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz Bands²⁶⁷.

²⁶⁶ See [S.I. No. 532/2016](#) - Wireless Telegraphy (3.6 GHz Band Licences) Regulations 2016.

²⁶⁷ i.e. The licence condition would require not less than six months' notice prior to any such termination by Licensees.

7.6.2 Views of respondents to Document 19/59R

7.233 ComReg received one response, from Eir, in relation to this matter. Eir agreed in principle with the proposal, but indicated that it could not agree with a “substantively the same” arrangement until it saw the precise specification.

7.6.3 ComReg’s assessment of respondents’ views

7.234 Firstly, ComReg notes that no respondents disagreed with the proposal to set a notification of the termination of a technology licence condition.

7.235 In considering Eir’s comments, ComReg recalls that in **Footnote 685** of Document 19/59R, it cited, as an example of a termination of a technology licence condition on substantively the same terms as the licence condition proposed for the Proposed Bands, the relevant licence condition included in S.I 251 of 2012, which applied to licences issued for the 800 MHz, 900 MHz and 1800 MHz GHz Bands on foot of the 2012 MBSA, i.e:

“6. It shall be a condition of any Licence to which these Regulations apply, that the Licensee shall:

(12) (a) notify the Commission, not less than 6 months prior to the proposed cessation of use of any terrestrial system listed in Schedule 1 to which the Liberalised Use Licence relates and; (b) use all reasonable endeavours, to ensure that any adverse effects on users from the cessation of use of a terrestrial system are minimised;”

7.236 In that regard, ComReg can clarify that it in proposing substantively the same licence condition as that cited above, it proposes to apply the same condition to licenses issued for the Proposed Bands, with the wording adapted, as appropriate, to refer to the types of licenses applicable to the Proposed Bands and to align with the relevant schedules in those licences.

7.6.4 ComReg’s updated position

7.237 In light of the above, ComReg’s proposal to attach a licence condition (in respect of notification of the termination of a technology) to spectrum rights in the Proposed Bands remains unchanged from Document 19/59R.

7.7 Potential wholesale access (MVNO) conditions

7.7.1 Summary of ComReg’s view in Document 19/59R

7.238 In section 8.7, ComReg set out some preliminary observations as to whether, in the context of ComReg’s obligation to promote effective competition (and to avoid distortions of competition in the internal market for ECS), it may be

appropriate to attach wholesale access (MVNO) conditions to some or all of the 700 MHz rights of use.

7.239 In order to determine whether it would be appropriate to attach such conditions, ComReg sought views and supporting material from interested parties regarding MVNO's and in particular:

- the extent to which MVNOs generally have been effective or otherwise in promoting competition to the benefit of consumers;
- the extent to which the MVNOs facilitated by the EC's Commitments currently provide, or would be likely to provide in the foreseeable future, an effective competitive constraint in the Retail Market;
- the barriers to entry for potential entrants and barriers to expansion for existing MVNOs;
- the extent to which access has been denied (actually or constructively) to any potential MVNO entrant in the past and the circumstances of same;
- which type of MVNO obligation approach (capacity or retail minus or other) would be best suited to increasing the competitive strength and incentives of any potential MVNO entrant.
 - if capacity, what overall target would be required (e.g. enough to replicate H3GI pre-merger?)
 - if capacity, what quantum of capacity would be required (e.g. by reference to EC's limit of 15% of merged entity's capacity per MVNO);
- information on MVNO models that would:
 - enable a new MVNO entrant to provide competitive prices and services in the Retail Market;
 - create a sustainable and long-term market player in the Retail Market;
 - allow a new MVNO entrant to provide a full range of services (voice, text and data) that can compete with other operators now, and in the future;
 - be suitable to attract strong MVNO competitors with economic incentives that are similar to those of MNOs; and

submits that:

- ComReg should examine the Czech and French precedents that imposed detailed wholesale MVNO access conditions on all 700 MHz licensees.
- ComReg should examine the Austrian MVNO commitment by Three when acquiring Orange including the publication of a reference offer for wholesale MVNO access.
- The Irish 2002 3G “A Licence” retail minus approach did not result in MVNO entry because of a lack of specification of obligations going beyond pure wholesale pricing.
- The 2014 “capacity agreement” commitment from the Three/O2 merger produced modest results – ID Mobile exited the market and Virgin Media’s market share is comparatively small. It is questionable, in its view, whether Virgin Media constitutes a genuine competitive constraint on Ireland’s MNOs.

7.243 In relation to the views and supporting material sought by ComReg, MVNO Europe submits that:

- It would be appropriate for ComReg to attach wholesale access conditions to some or all of the 700 MHz rights of use.
- Bidders should have the opportunity to make a voluntary commitment to extend existing wholesale access in return for lower spectrum fees.
- The wholesale access conditions should support a multi-MVNO/MVNE market constellation.
- The scope, quality and geographic coverage of wholesale access must not be worse than the same provided to MNOs own customers.
- A clause should be provided to prevent margin squeeze for voice/SMS/data.
- The wholesale access obligation needs to be framed in terms of enabling the provision of any service.
- The publication of a reference operator for full MVNO/E access is needed and should be subject to ComReg supervision.
- A dispute-settlement mechanism with ComReg acting as arbitrator.

- Sanctions should be available in the event of MNO non-compliance.

7.244 MVNO Europe also provides a description of what it considers Full MVNO access to look like in both technical and commercial terms.²⁶⁸

7.245 Eir submits that an MVNO access condition is not justified and claims that ComReg can only impose access obligations when it has clearly identified a market failure following a proper market review.

7.246 Three submits that it is not necessary to include an MVNO condition for the following reasons:

- Existing MVNOs have made a positive contribution to retail competition.
- There is no identified barrier to market entry for MVNOs that would be resolved by the imposition of obligations.
- An MVNO obligation might act as a barrier to a new entrant bidder.
- Applying an MVNO obligation only to some bands might skew the auction towards certain bands and deliver an inefficient outcome.

7.7.3 ComReg's assessment of respondents views to Document 19/59R

7.247 Given the issues raised by respondents ComReg will carry out a detailed study in relation to MVNO obligations in a separate process.

7.248 ComReg is of the preliminary view that given the information provided by respondents, it is not appropriate at this time to attach MVNO access obligations to some or all of the 700 MHz rights of use for, amongst other reasons, those set out below:

7.249 **First**, in order to justify the inclusion of a MVNO obligation, ComReg would need to complete a detailed review of competition in mobile markets to determine whether there exists a market failure that could be remedied, by the inclusion of a MVNO obligation. ComReg notes that New Zealand's Commerce Commission recently completed such a review in 2 years, concluding that MVNO obligations were not necessary in an upcoming spectrum award.²⁶⁹ Given the need for extensive consultation, it is likely that such an assessment would take ComReg a similar period of time to complete. A review on the merits of including MVNO access obligations would likely delay the MBSA award for

²⁶⁸ "MVNO Europe – Response to ComReg 19/59R – 7 August 2019" p 9

²⁶⁹ <https://comcom.govt.nz/regulated-industries/telecommunications/projects/mobile-market-study>

up to 2 years, and could ultimately find that such an obligation is not justified.

7.250 **Second**, in attempting to design appropriate and effective MVNO licence conditions, there would be many non-trivial substantive and procedural issues to resolve, including:

- would the MVNO licence condition be applied across all new 700 MHz rights of use or a subset?
- would the MVNO obligation be the more typical “pay-as-you-go” type or capacity-based?
- what level of capacity would a MVNO require to ensure a successful competitive entry?
- what metric would be employed to determine the quantum of an MNO’s network capacity that would be subject to the obligation? What quantum of spectrum would be appropriate to remedy any competition concerns?”
- how might this spectrum quantum evolve over time? Is it static or does it increase in line with any increases in MNOs network capacity, for example.
- how would the price for any access be determined and how would this be monitored?

7.251 Noting some of the non-trivial substantive and procedural issues to resolve as identified above, a significant amount of time would be required to action, evaluate, consider and determine the most appropriate course of action in relation to each. This would have to be achieved in the context of the expected timing for the release of spectrum in the 700 MHz band, where there is already external stakeholder expectation within the EC²⁷⁰, DCCAE²⁷¹, and national stakeholders²⁷² that the award of the 700 MHz band will commence in 2020.

7.252 **Third**, a number of significant award distortions could arise depending on the type of MVNO access obligations, if any. Such distortions could compromise

²⁷⁰ Decision 2017/899 of the European Parliament and Council of 17 May 2017 on the use of the 470-790 MHz frequency band in the EU (“UHF Band EP&C Decision”) identifies 30 June 2020 as the date by which Member States shall allow the use of the 700 MHz Band for terrestrial systems capable of providing WBB ECS and only under the harmonised technical conditions set out in the 700 MHz EC Decision

²⁷¹ Ireland’s national roadmap for the use of the 700 MHz band is set out on the DCCAE website.

<https://www.dccae.gov.ie/documents/700MHz%20Roadmap.pdf>

²⁷² Respondents to Document 19/59R supported the timely release of the MBSA2 spectrum bands, and in particular the 700 MHz band given its favourable propagation characteristics and its identification as a 5G pioneer band.

ComReg's ability to design an award in furtherance of its objectives to promote competition, and take all reasonable measures to encourage efficient use and ensure effective management of radio frequencies. In particular, an effective MVNO obligation is likely to impose costs on operators since such an obligation would likely provide for access in excess of what an MNO would be willing to provide commercially²⁷³ and ComReg would have to consider same in designing any MVNO obligation.

7.253 For example, a symmetric capacity based obligation could create the risk of a number of distortions during the award, including:

- Asymmetries between bidders, advantaging stronger incumbents (i.e. those with greater spectrum holdings) who are more likely to be able to provide for capacity MVNO obligations at a lower relative cost;
- Reduced competition from a limited field of potential suppliers results in spectrum rights of use being sold at a price which no longer ensures its optimal use²⁷⁴;
- The winner of a MVNO lot could leverage its strong position to win additional spectrum it might not otherwise have won, potentially distorting competition²⁷⁵;
- Capacity obligations on the 700 MHz Band could also distort demand for complementary bands at higher frequencies such as 2.6 GHz.

7.254 **Fourth**, the various design elements which ComReg has already provided preliminary views on (minimum prices, award type, coverage, lot size etc.) would potentially require reassessment, since those views were provided on the basis of a potentially costly MVNO obligation **not** being included. This is important, as the inclusion of the MVNO obligation would impact the rationale underlying ComReg's decisions on preferred design elements. For example, ComReg's preferred option in relation to minimum prices was determined through the use of benchmarking as an approach to determine a conservative minimum price. As an MVNO obligation may impose a cost on an operator, it

²⁷³ Such obligations may be intended to force one or more network operators to conclude MVNO access agreements they would never have provided commercially. Such obligations necessarily come with a cost to operators, as any benefits in terms of additional revenue from providing access could risk being exceeded by the reduction in revenues arising from increased competition at retail level. Ultimately, the more stringent the MVNO obligation, the larger the potential distortion to the award and to competition downstream.

²⁷⁴ For example, some MNOs may not be interested in 700 MHz with MVNO obligations or as above some MNOs have better capacity to provide for MVNO obligations than others.

²⁷⁵ The lower cost to such an operator of providing the MVNO obligation could be used to compete for additional spectrum it would not have won under normal competition.

could potentially reduce the value of the spectrum. An MVNO obligation therefore increases the risk of minimum prices that are too high, potentially resulting in a negative impact on competition²⁷⁶ or choking off demand²⁷⁷.

7.255 **Fifth**, a consideration of each of these items as described would delay the MBSA award and prolong timelines considerably. Such a delay would result in a significant delay in the release of the relevant spectrum bands. This could lead to a delay in the deployment of new and improved infrastructure for mobile services, and in the resulting economic and consumer benefits.

7.7.4 ComReg's updated position

7.256 In light of the above, ComReg is of the preliminary view that given the information provided by respondents, it is not appropriate at this time to attach MVNO access obligations to some or all of the 700 MHz rights of use. Notwithstanding, ComReg is of the view that there would be benefit in commencing a study that considers the current and future role of MVNOs in the Irish mobile market ("MVNO Study") which, among other things, would:

- assess what the different types of MVNOs and their business models;
- provide an overview of the economics of MVNOs services and the conditions under which the presence of MVNOs could be welfare enhancing;
- describe the regulatory approaches and experience of MVNOs internationally;
- assess the current state of MVNOs in Ireland, including their market share, their business strategies, the services they offer, and other such measures to provide a view of the role played by MVNOs; and
- explore the future evolution of the MVNO Market given current market conditions and emerging trends.

7.257 The MVNO Study would provide ComReg with up to date relevant information on MVNOs and would, among other things:

- inform ComReg's understanding of the role that MVNOs play in the mobile market;
- provide ComReg with insight into how MVNOs affect the competitive

²⁷⁶ In the event that smaller participant/new entrants are discouraged from participating.

²⁷⁷ Uncertainty about the cost of an MVNO obligation makes it difficult to set reserve prices as benchmarks typically do not have stringent MVNO obligations priced in.

dynamic of the mobile market; and

- inform ComReg's understanding of the entry conditions faced by MVNOs;

7.258 ComReg will therefore initiate this project in Q1 2020 engaging with relevant stakeholders in considering the matters above. Finally, the various responses received in relation to MVNOs as part of Document 19/59R will inform this MVNO Study.

7.8 Spectrum transfers, spectrum leasing and spectrum hoarding

7.8.1 Summary of ComReg's view in Document 19/59R

7.259 In Section 8.8 of Document 19/59R, ComReg set out its proposals in relation to spectrum transfers, spectrum leases, and spectrum hoarding in the Proposed Bands. In summary ComReg proposed to:

- allow spectrum transfers in all of the Proposed Bands by amending its Spectrum Transfer Framework to include the 700 MHz and 2.3 GHz bands in addition to the currently included 2.1 GHz and 2.6 GHz bands;
- allow spectrum leases in the 2.3 GHz band, although that band is not currently subject to any EU spectrum leasing requirements and is not included in ComReg's proposal in Document 17/82 for a spectrum leasing framework which includes the other Proposed Bands; and
- impose an obligation on winners of liberalised spectrum rights in the Proposed Bands to comply with any rules to prevent spectrum hoarding as may be laid down by ComReg under Regulation 17(10) of the Framework Regulations.

7.260 ComReg observed that its spectrum transfer and spectrum leasing proposals would provide consistency across the Proposed Bands and that its proposed spectrum hoarding obligation would be consistent with the spectrum hoarding obligations that currently exist in respect of the spectrum rights issued in the 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz Bands.

7.8.2 Views of respondents to Document 19/59R

7.261 Three agreed that spectrum transfer and leasing should be permitted in all of the Proposed Bands. Eir and Three sought an update on when ComReg expected spectrum leasing legislation to be signed into law. ComReg did not receive any responses in relation to its spectrum hoarding proposals.

7.8.3 ComReg's assessment of respondents' views

7.262 Firstly, ComReg notes that no respondents disagreed with ComReg's proposals in relation to spectrum transfers, spectrum leasing and spectrum hoarding for the Proposed Bands and that one respondent explicitly agreed with ComReg's proposal for spectrum transfers and spectrum leasing.

7.263 With regard to respondents' requests for an update on the signing into law of spectrum leasing legislation, ComReg anticipates that consent to the making of relevant regulations will be given by the Minister for Communications Climate Action and Environment during the first quarter of 2020.

7.8.4 ComReg's updated position

7.264 In the light of the above, ComReg's proposals in relation to spectrum transfers, spectrum leasing and spectrum hoarding in the Proposed Bands remain unchanged from Document 19/59R.

7.9 Technical Conditions

7.9.1 Summary of ComReg's view in Document 19/59R

7.265 In Annex 12 of Document 19/59R ComReg set out its proposed technical licence conditions applicable for rights of use in the 700 MHz Duplex, the 2.1 GHz Band, the 2.3 GHz Band and the 2.6 GHz Band.

7.266 The technical conditions set out in 19/59R take the form of a block edge mask (BEM) for different usage scenarios and channelling arrangements. In general the BEM definition includes the following and are as defined in the EC Decisions for each of the relevant bands²⁷⁸, and as per the ECC Decision²⁷⁹ in the case of 2.3 GHz Band:

- In-block:
 - base station power limits; and
 - terminal station power limits
- Out-of-block:
 - baseline power limits
 - transitional region power limits i.e. power limits for a range of frequencies above and below the block assigned to the operator; and

²⁷⁸ Namely the [2.1 GHz EC Decision](#), [700 MHz EC Decision](#) and [2.6 GHz EC Decision](#), available at <https://eur-lex.europa.eu/>

²⁷⁹ [ECC Decision \(14\)02](#), available at <https://www.ecodocdb.dk>.

- Guard band emission limits (specifically for FDD channelling arrangement).

7.267 For each of the Proposed Bands ComReg identified that there is a requirement that deployments will be subject to the co-ordination thresholds and corresponding procedures as set out in the respective cross border memorandum of understandings (MoU).

7.9.2 View of Respondents to 19/59R

700 MHz Duplex

7.268 ComReg received three responses in relation to the 700 MHz Duplex technical conditions, from Ericsson, Virgin Media and Motorola.

7.269 Ericsson noted in its response that the EIRP limits would be better described as the “Maximum mean EIRP limits”. Ericsson contends that this suggestion further aligns with ComReg proposal to set out conditions in line with the 700 MHz EC Decision. Ericsson also highlighted a need in its view to have the measurement bandwidth represented in the description of each power level limit in the 700 MHz Duplex.

7.270 Virgin Media highlighted its concerns with regard to the award of 700 MHz Duplex and the possibility that high powered base station downlinks and customer handsets in the uplink frequency may cause interference to its cable network. Virgin Media in its response suggested that ComReg consider requesting MNO’s to inform Virgin Media in advance of the upcoming launch of services in the 700 MHz Duplex so that mitigation measures by Virgin Media can be undertaken prior to the rollout of MFCN in the 700 MHz Duplex.

7.271 Motorola noted in its response that:

“Recognizing the 700MHz band as a 5G “Pioneer” band, it should not be forgotten to mandate the BEM for LTE/5G NR in all segments of the 700MHz band”

2.1 GHz Band

7.272 ComReg received one response in relation to the 2.1 GHz technical conditions from Ericsson.

7.273 Ericsson highlighted that the current ECC Decision (06)01 has been recently updated and suggests that this ECC decision should be incorporated into the technical conditions of the Proposed Award. Ericsson notes that the current 2.1 GHz EC Decision was published in 2012 and does not address AAS (Active Antenna Systems).

2.3 GHz Band

7.274 ComReg received no comments specifically referring to the 2.3 GHz technical conditions. Comments received regarding 2.3 GHz RurTel transition and migration options are considered in Chapter 5 and 8.

2.6 GHz Band

7.275 One respondent (Ericsson) notes that AAS has not been given consideration in the consultation and that the 2.6 GHz EC Decision was published in 2008. Ericsson notes that the current ECC Decision (05)05 has been recently updated (July 2019) and this ECC decision should be incorporated into the technical conditions to take into account AAS.

7.9.3 Updated information

7.276 In relation to the 2.1 GHz Band and 2.6 GHz Band, a draft EC Decision to amend EC Decision 2012/688 and EC Decision 208/477 respectively, was discussed at the Radio Spectrum Committee meeting (RSC#69) of 11th December 2019. ComReg observes that any revisions of these EC Decisions will, among other things, facilitate the deployment of AAS in the 2.1 GHz Band and the 2.6 GHz Band.

7.277 The RSC#69 meeting continued to discuss the draft EC decision documents and the EC have requested further comment from national administrations with a view to stabilising the documents in Q2 2020.

7.278 In relation to the international coordination MoU's these are now available on the ComReg website²⁸⁰.

7.9.4 ComReg's assessment of respondents' views and preliminary view

700 MHz Duplex

7.279 In relation to measurement bandwidth and power limit description noted by Ericsson, ComReg acknowledges that the 700 MHz EC Decision provides that,

“Optional in-block power limits are given in Table 2. Out-of-block power limits for different BEM elements are given in Table 3 to Table 8”

7.280 The 700 MHz EC Decision also defines the power in Table 2 to Table 8 as a “maximum mean EIRP” with an associated measurement bandwidth.

²⁸⁰ [International Coordination of Radio Spectrum](#)

7.281 Considering the above, ComReg is of the view that the proposed text from Ericsson would further align its proposals with the 700 MHz EC Decision. ComReg agrees with Ericsson's suggested amendments relating to the 700 MHz Duplex technical conditions, specifically in relation to the measurement bandwidth "across 5 MHz bandwidth" and the power limit description referring to, "a maximum mean" EIRP. ComReg will implement these suggested changes in the 700 MHz Duplex technical conditions.

7.282 Virgin Media highlighted an issue regarding its network being susceptible to interference from MFCN deployments in the 700 MHz Band. ComReg notes that Annex 1 of the Electromagnetic Compatibility Directive²⁸¹ provides:

"1. General requirements

Equipment shall be so designed and manufactured, having regard to the state of the art, as to ensure that:

(a) the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;

(b) it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

2. Specific requirements for fixed installations

Installation and intended use of components

A fixed installation shall be installed applying good engineering practices and respecting the information on the intended use of its components, with a view to meeting the essential requirements set out in point 1."

7.283 With regard to (1) and (2) above, ComReg observes the responsibility for compatibility with other equipment including wireless telegraphy is a matter for the operator of the relevant network.

7.284 Also and from the other perspective, ComReg notes Article 19, section 2 of the Electromagnetic Compatibility Directive of 2014 states that;

"Where there are indications of non-compliance of the fixed installation, in particular, where there are complaints about disturbances being generated by the installation, the competent

²⁸¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0030&from=EN>

authorities of the Member State concerned may request evidence of compliance of the fixed installation, and, when appropriate, initiate an evaluation. Where non-compliance is established, the competent authorities shall impose appropriate measures to bring the fixed installation into compliance with the essential requirements set out in Annex I.”

7.285 Although no longer within ComReg’s remit, it is noted that Document 98/66R2 section 6.1²⁸² sets out a detailed process as to how cable leakage issues should be resolved by the authorised person (i.e. the operator of the cable network):

“Where signal leakage is detected and is deemed by the Commission to be causing interference to any service contained in the categories listed in points 9.1 (a) to (d), the authorised person shall take whatever steps are necessary at their own expense to immediately eliminate the interference. If they are unable to eliminate the interference the offending channel, including all carriers, shall be removed from the cable relay network, until the matter is resolved to the satisfaction of the Commission for Communications Regulation.”

7.286 ComReg considers the Virgin Media concerns regarding the impact of MFCN deployment in the 700 MHz Duplex to be a matter that it itself must resolve. In light of the above, ComReg does not propose to implement any technical requirement for network operators to notify Virgin Media prior to deployment.

7.287 ComReg does however note that in the interests of cooperation between operators of networks, where certain situations come to the attention of installers, for example where rooftop mounted base station antennas are noticeably close to Virgin Media’s cables, it may be in the interest of both operators that installers notify Virgin Media. However ComReg does not suggest any obligation in this regard.

7.288 Regarding Motorola’s comment, ComReg notes that the proposals in Document 19/59R relate specifically to the 700 MHz Duplex. Any future use of other parts of the 700 MHz band are not considered as part of this consultation process.

The 2.1 GHz Band and the 2.6 GHz Band

7.289 ComReg observes the comments from Ericsson regarding the updated 2.1 GHz ECC Decision (06)01 and 2.6 GHz ECC Decision (05)05. While ComReg is aware of the AAS technical conditions set out in ECC Decision (06)01 and ECC Decision (05)05, ComReg notes that the relevant amended EC Decisions for these bands have yet to be finalised. ComReg notes that the process for

²⁸² <https://www.comreg.ie/publication/conditions-for-the-operation-of-a-digital-cable-relay-network-issued-under-an-authorisation>

considering these amendments in Radio Spectrum Committee (RSC) is currently underway.

- 7.290 ComReg is of the view that proposing to set technical conditions that are not currently in the relevant EC Decisions requires careful consideration. Firstly, such conditions may not be allowed under the current provisions of the relevant EC Decision, and secondly the implementation of any such conditions would in effect pre-judge the discussion and adoption of a revised EC Decision where there may well be items of uncertainty or discretion to be finalised.
- 7.291 Noting the above, ComReg's current view is that it is not currently appropriate to update the technical conditions for the 2.1 GHz and 2.6 GHz Bands to facilitate AAS. However, as implemented in the 3.6 GHz Band licence conditions, ComReg notes that it may, if required and appropriate to do so, amend the technical conditions, when and if the relevant EC decision is amended and made publically available. For the avoidance of doubt, ComReg reserves the right to make changes required by such decisions, if and when they are published, up to and including issue of a final Information Memorandum in relation to the Proposed Award, without further consultation.
- 7.292 In considering responses to Document 19/59R, ComReg has revised, where appropriate for each of the spectrum bands, the technical licence conditions that are applicable for any new rights of use in the specific bands. The revised technical licence conditions proposed by ComReg are outlined in the Technical Conditions Annex to this document (Annex 14).

7.9.5 Other updates to the technical conditions

- 7.293 In this section, ComReg outlines the specific technical conditions which are applicable to the Proposed Bands. A summary of these conditions are detailed below for each of the Proposed Bands.

700 MHz Duplex

- 7.294 ComReg notes in Document 19/59R that if a bidder were to win more than 2x10 MHz of the available spectrum in the 700 MHz Duplex the winning bidder would be prevented, by way of licence condition, from deploying a channel bandwidth greater than 2x10 MHz starting at 703 MHz unless it can demonstrate that it can meet the unwanted emission power of -42 dBm/8MHz. in the frequency range 470-694 MHz.
- 7.295 In Document 19/59R ComReg outlined different scenarios for this spectrum being awarded and the likely assignment of the spectrum were a network operator is awarded greater than 2x10 MHz.

2.3 GHz Band

7.296 ComReg identified two coexistence considerations relating to the 2.3 GHz band:

- the two uppermost 5 MHz blocks in the band (2390 - 2400 MHz) are adjacent to WLAN's operating above 2400 MHz; and
- in the lower end of the 2.3 GHz band, Eir holds a number of licences in the range 2307 - 2327 MHz for its RurTel Network

7.297 With regards to WLANS, ComReg proposed in Document 19/59R to implement a BEM as provided for in the 2.3 GHz ECC Decision. As discussed in Chapter 5, this BEM is understood to be sufficient to mitigate potential adjacent band interference from MFCN base stations with WLAN networks.

7.298 Regarding Eir's RurTel network, Plum provided its analysis and recommendation in Document 19/59d and provided an update to this report in Document 19/124c. Based on Plums analysis and as discussed in Chapter 5, ComReg proposed that for MFCNs to be deployed in areas surrounding RurTel base station receivers, coordination between proposed MFCN deployments and existing RurTel networks is required. While noting that the RurTel network may be further reduced or migrated fully from the 2.3 GHz Band, the requirement for a coordination procedure should be assessed to reflect these changes.

7.299 ComReg has outlined its coordination procedure in the form of a technical licence condition in Annex 14 of this document.

2.6 GHz Band

7.300 There are two main considerations for ComReg in the award of spectrum in the 2.6 GHz Band, which are:

- Restricted blocks where the FDD and TDD blocks are adjacent to each other, specifically blocks 2570 - 2575 MHz and 2615 - 2620 MHz; and
- Compatibility considerations between MFCN in the 2.6 GHz Band and aeronautical radars operating in the 2700 - 2900 MHz frequency range.

7.301 ComReg proposed in Document 19/59R that the in-block levels and BEM identified in the 2.6 GHz EC Decision for restricted blocks apply to the blocks 2570 - 2575 MHz and 2615 - 2620 MHz. These technical conditions are detailed in Annex 12 of Document 19/59R. ComReg also proposes that these two blocks are awarded as frequency specific blocks.

7.302 As detailed in Chapter 5, ComReg intends to implement mitigation measures recommended by Plum in its 2.6 GHz report (Document 19/59c) and updated

report Document 19/124c to ensure coexistence between aeronautical radars operating in the 2.7 GHz band and new MFCN base stations in the 2.6 GHz Band.

7.303 For MFCN operators in the 2.6 GHz Band, ComReg proposes:

- in relation to the Star 2000 radars to:
 - impose a pfd limit on out-of-band emissions of -145 dBW/m²/MHz on MFCN base stations per operator at the radar antenna to address the impact of MFCN spurious emissions;
 - that if MFCNs are deployed before filters are installed at the aeronautical radar, an additional out of band pfd limit of -83 dBW/m² be imposed to address the impact of blocking and intermodulation effects at radar receivers during the transition period (to be defined)²⁸³; and
 - impose a coordination zone of 1 km around the aeronautical radar to provide additional protection from MFCN base stations.
- In relation to TA10 radar to
 - address the impact of spurious emissions impose a pfd limit of -156 dBW/m²/MHz at the radar receiver antenna location; and
 - address the impact of blocking and intermodulation effects at radar receivers in the adjacent band impose a pfd limit of -93 dBW/m² at the radar receiver;

7.304 The above mitigation measures are included as part of technical conditions Annex (Annex 14).

TDD Inter-network synchronisation – Summary of Document 19/59R

7.305 In Document 19/59R, ComReg emphasised the importance of synchronisation across networks. In particular, synchronisation of TDD deployments helps to minimise intra-network interference and maximise frequency re-use.

7.306 The advantages of TDD synchronisation include:

- When synchronisation is utilised, the Base Station (BS) to BS adjacent channel interference path is removed allowing the networks to co-exist without the need for guard bands. Furthermore, the BEMs for the 2.3 GHz Band and the 2.6 GHz Duplex Gap, as set out in the 2.3 GHz ECC

²⁸³ Following successful installation of radar filters, this limit on MFCN base stations will no longer be required to protect radar services.

decision²⁸⁴ and the 2.6 GHz EC Decision²⁸⁵ respectively, are more permissive for synchronised TDD networks and more restrictive for unsynchronised networks; and

- Synchronisation can be used as an interference mitigation measure for cross border co-ordination, allowing services to be provided closer to either side of the regional border than with unsynchronised networks.

7.307 ComReg highlights ECC Report 216²⁸⁶ in Document 19/59R which outlines the requirements for synchronisation to be achieved between networks. These requirements are:

- Operators must have a common reference phase clock to ensure alignment of the start of the frame; and
- Compatible frame structures must be utilised by all operators. These frame structures define the timeslots for uplink and downlink and to achieve synchronisation these time slots need to be aligned.

7.308 In order to address these considerations, ComReg proposed the following structures in Document 19/59R:

- Not setting guard bands between assignments. This requires unsynchronised networks to internalise guard bands to meet the relevant technical conditions;
- Setting a permissive BEM for synchronised networks and restrictive BEM for unsynchronised networks; and
- Setting a default frame structure.

7.309 ComReg notes that cooperation between the network operators is required to ensure inter-network synchronisation. In this regard, ComReg recommends implementing the practical guidance in arranging TDD network synchronisation as detailed in ECC Report 216.

Default Frame Structure

7.310 ComReg noted in Document 19/59R that to achieve synchronisation between networks, a common frame structure must be used. Setting a default frame structure would allow for a first operator to rollout in a region and have certainty as to which BEM would apply to it. This would allow for greater speed to market

²⁸⁴ [ECC Decision \(14\)02](https://www.ecodocdb.dk), available at <https://www.ecodocdb.dk>

²⁸⁵ [2.6 GHz EC Decision](#)

²⁸⁶ [ECC Report 216](#), available at www.ecodocdb.dk

and negate the need for inter operator negotiations on an appropriate frame structure.

7.311 There are currently seven TD-LTE frame structures defined by 3GPP. The table below sets out the configuration of each option and the associated DL:UL ratio.

Table 12: TD-LTE frame structure options

UL-DL Configuration	Subframe number										DL:UL Ratio
	0	1	2	3	4	5	6	7	8	9	
0	D	S	U	U	U	D	S	U	U	U	1:3
1	D	S	U	U	D	D	S	U	U	D	1:1
2	D	S	U	D	D	D	S	U	D	D	3:1
3	D	S	U	U	U	D	D	D	D	D	2:1
4	D	S	U	U	D	D	D	D	D	D	7:2
5	D	S	U	D	D	D	D	D	D	D	8:1
6	D	S	U	U	U	D	S	U	U	D	3:5

**where U is for uplink transmission, D is for downlink transmission and S is a "special" subframe used for a guard time*

7.312 ComReg considered the following factors in its proposal on TD-LTE frame structure in Document 19/59R;

- that for the 3.6 GHz Award, and as proposed in Document 15/70²⁸⁷ as part of the process, ComReg applied TD-LTE configuration 2 for TDD spectrum; and
- Ofcom in its award of 2.3 GHz and 3.4 GHz²⁸⁸ TDD spectrum has indicated that it will set TD-LTE configuration 2 as the default structure for synchronisation.

7.313 In Document 19/59R, ComReg observed that setting a default frame structure would encourage synchronisation between networks and facilitate a quicker rollout of services.

7.314 Considering these points above in conjunction with the implementation of 3.6 GHz TDD and Ofcom's position in its 2.3 GHz and 3.6 GHz TDD spectrum awards; ComReg proposed to implement TD-LTE configuration 2 (i.e. 3:1 downlink to uplink ratio) as the default frame structure for the 2.3 GHz and 2.6 GHz TDD networks.

²⁸⁷ [ComReg – Consultation on Proposed 3.6 GHz Band Spectrum Award](#)

²⁸⁸ [Ofcom Information Memorandum – The award of 2.3 and 3.4 GHz spectrum bands](#)

View of Respondents to TDD inter-network synchronisation

7.315 ComReg received no comments specifically referring to the TDD inter-network synchronisation. The following section analyses the special sub-frame (SSF) configurations and compares their suitability for inclusion as a condition in this award.

Special Sub-Frame

7.316 ComReg did not present a proposal for the TDD inter-network synchronisation special sub-frame in Document 19/59R, nor did ComReg receive any submission in relation to same.

7.317 The TD-LTE Special Sub-Frame (SSF) consists of a downlink pilot signal, a guard period and an uplink pilot signal. The pilot signals can be used to provide additional downlink or uplink capacity and the guard period is used to control switching between uplink and downlink. The sum of the time allocated to the Special Sub-frame in TD-LTE is 1ms and is made up of 14 OFDM symbols with normal Cyclic Prefix (12 OFDM symbols with an Extended Cyclic Prefix). This is illustrated in Figure 10 below.

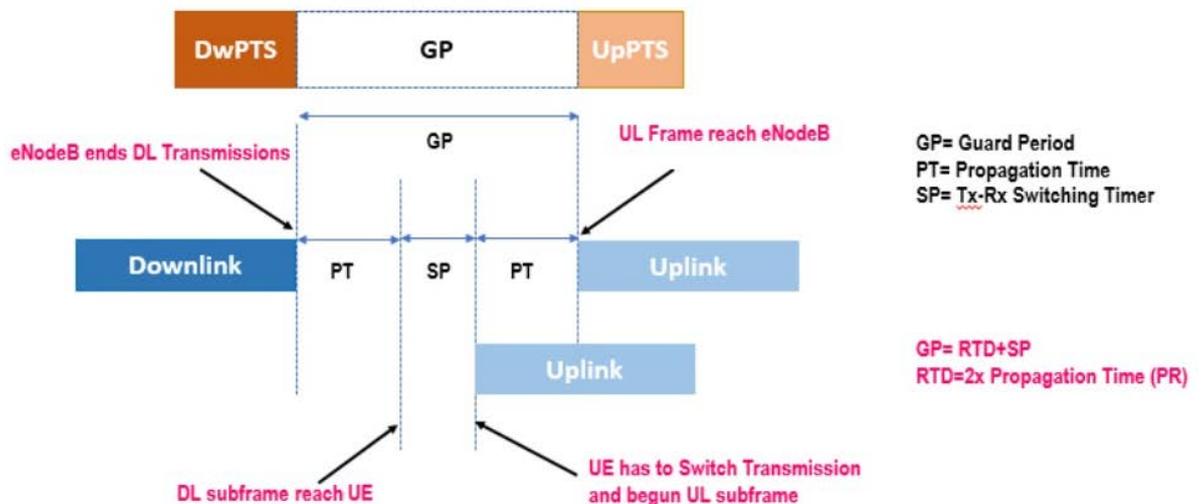


Figure 10: Special Sub-Frame²⁸⁹

7.318 A special sub-frame structure is compatible where there are no uplink transmissions within the downlink pilot timeslot or guard period and no downlink transmissions within the uplink pilot timeslot or guard period.

7.319 For example the breakdown of OFDM symbols allocated to DwPTS, GP and UpPTS for Special Sub-Frame configurations SSF6 and SSF7 is shown in

²⁸⁹ <http://www.techplayon.com/lte-tdd-special-subframe-and-its-significance-for-cell-size/>

Table 13.

Table 13: TD-LTE SSF 6 and SSF 7

TDD Special Sub-frame Configuration	DwPTS (Symbols)	Guard Period(Symbols)	UpPTS(Symbols)
6	9	3	2
7	10	2	2
DwPTS – Downlink Pilot Time Slot			
UpPTS – Uplink Pilot Time Slot			
GP – Guard period			

7.320 SSF 6 has the advantage of a larger Guard Period (GP) which allows for extended propagation time and as a result a larger cell radius is possible compared to SSF7. The theoretical maximum cell radius possible for TD-LTE is calculated below in Figure 11 for SSF6 and SSF7. ComReg notes that the Guard Period alone does not decide the cell size but it must be given consideration in the network planning process.

<p><u>SSF 6 : Cell Radius Calculation</u> Time equivalent of Guard Period(s) = (No. of Guard Period symbols/total symbols in SSF)/1000 $(3/14)/1000 = 0.000214\text{sec}$ Round Trip Distance = Speed of light(Km/sec) * time (sec) $300000 * 0.000214 = 64\text{km}$ Cell Radius = Round Trip Distance/2 $64/2 = 32\text{km}$</p>
<p><u>SSF 7 : Cell Radius Calculation</u> Time equivalent of Guard Period(s) = (No. of Guard Period symbols/total symbols in SSF)/1000 $(2/14)/1000 = 0.000142\text{sec}$ Round Trip Distance = Speed of light(Km/sec) * time (sec) $300000 * 0.000142 = 42\text{km}$ Cell Radius = Round Trip Distance/2 $42/2 = 21\text{km}$</p>

Figure 11: SSF 6 and SSF 7 TD-LTE Cell radius calculation

7.321 SSF 7 has the advantage of higher downlink throughput with the availability of additional symbols for downlink transmission, but where the cell range is limited relative to SSF 6.

7.322 A key consideration in choosing the TD-LTE SSF for the 2.3 GHz and 2.6 GHz

TDD bands is to consider which option will facilitate some operators deploying LTE initially and also allow operators to deploy 5G NR in these bands into the future where compatibility between these two types of deployment is possible.

7.323 In considering the Special Sub-frame ComReg is guided by previous TDD awards within Ireland (i.e. the 3.6 GHz Award), recent European awards of TDD Spectrum, input from mobile communications vendors and technical consultants Plum.

7.324 In the 2017 Irish award of 3.6 GHz TDD spectrum, ComReg selected TD-LTE configuration 2 Special Sub-frame 6 as the default configuration. This decision was guided by a need for compatibility between TD-LTE, WIMAX and other technologies while balancing considerations related to the likely requirements for throughput. ComReg notes however that WIMAX is no longer being pursued by operators where deployments tend to favour TDD-LTE and 5G-NR technologies.

7.325 ComReg has observed recent and upcoming European awards of TDD spectrum, in particular:

- that ARCEP²⁹⁰ in its upcoming award of the 3.6 GHz Band, is proposing TD-LTE configuration 2 SSF7; and
- that Ofcom have opted for LTE configuration 2 SSF6 in its award of the 2.3 GHz and 3.4 GHz TDD²⁹¹ bands.

7.326 ComReg sought input from mobile telecommunications industry vendors^{292,293,294} as to what TD-LTE configuration they recommend to best

²⁹⁰ [Arcep – Draft Decision proposing the procedure for awarding the 3490 – 3800 MHz band in Metropolitan France](#)

²⁹¹ [The award of 2.3 and 3.4 GHz spectrum bands Information Memorandum](#)

²⁹² [REDACTED]

²⁹³ [REDACTED]

²⁹⁴ [REDACTED]

ensure forward compatibility between TD-LTE and 5G deployments and to provide information on the frame structures that are compatible between typical LTE and 5G deployments.

- 7.327 Mobile vendors all indicated that LTE configuration 2 is the most appropriate configuration and offered different options on the TD-LTE Special Sub-Frame, all of which had a corresponding compatible 5G-NR equivalent which would allow synchronisation of the guard periods. The slot format of the 5G-NR special sub-frame is adaptable and can be configured to match any TD-LTE Configuration.
- 7.328 ComReg notes that for TD-LTE the frame configuration 2 is the most widely used frame structure. In 5G-NR the frame structure of 8:2 DL/UL ratio (DDDDDDDSUU) with 5ms DL/UL switching period can be adopted to attain synchronisation with LTE configuration 2.
- 7.329 Further the, 5G-NR slot format configuration is flexible and can be matched to all configurations of special sub-frame in TD-LTE.
- 7.330 In light of the above, and considering the current default configuration for the 3.6 GHz Band and the coverage advantages afforded by TD-LTE Configuration 2, ComReg is of the view that SSF 6, is the most appropriate configuration for TDD synchronisation for the Proposed Award.

Procedures for Inter-operator Synchronisation Agreement

- 7.331 In relation to an inter-network synchronisation procedure, ECC Report 216 states that in order to deploy synchronised TDD networks in a multi-operator context (without guard bands), agreement needs to be reached on a common phase clock and a compatible frame structure. Operators must also make commitments not to cause interference and to comply with cross-operator synchronisation requirements where these restrictions apply. Finally, the procedure for updating or amending inter-operator agreements must be clear.
- 7.332 In order to provide certainty to operators in advance of the award process, ComReg proposes the following inter-network synchronisation procedure for the use of permissive masks:
- a common phase clock reference (e.g. UTC) must be adopted in order to align the start of the frame, with phase alignment to the reference clock within +/- 1.5 μ s;

[REDACTED]

- a frame structure based on TD-LTE configuration 2 (3:1) or a compatible frame structure if a different technology must be used;
- TD-LTE Special sub frame configuration 6 is assumed as the default frame structure. Where other frame structures or technologies are used, the uplink and downlink transmit periods must be synchronised and not exceed those of TD-LTE SSF configuration 6;
- a commitment must be made by all operators not to cause interference on other operators' networks; and
- indoor small cells within an EIRP of less than or equal to 24 dBm per carrier are exempted from synchronisation and may use permissive masks²⁹⁵ provided that these do not cause interference to any other operators.

Updating Inter-operator Synchronisation Agreements

7.333 In the event that licensees wish to change any of the parameters above, parties to an existing inter-operator agreement should first discuss and agree the exact parameters they wish to change. They should then notify ComReg of their desire to make these changes.

7.334 ComReg will then review the proposed changes. Provided the proposed changes do not cause interference to other operators, ComReg will revise the inter-operator synchronisation procedure and notify all licensees of the change. It should be noted that ECC report 216 states that the frame structures are software parameters and can be reconfigured relatively quickly without causing any significant delays or major disruption to customers.

ComReg's position

7.335 As proposed in Document 19/59R, ComReg remains of the view that it should put in place a framework to encourage inter-network synchronisation, which will facilitate the efficient use of radio spectrum, provide certainty to operators and allow a prompt rollout of services. ComReg therefore proposes:

- not setting guard bands between assignments: This would require unsynchronised networks to internalise guard bands to meet the relevant technical conditions;

²⁹⁵ ComReg proposed in Document 19/59R exempting small cells (with an EIRP not exceeding 24 dBm) in indoor and other indoor locations from synchronisation restrictions. ComReg received no comments on this proposal. Therefore, ComReg is of the view that indoor small cells within an EIRP of less than or equal to 24 dBm may use permissive masks.

- setting a permissive BEM for synchronised networks and restrictive BEM for unsynchronised networks, where the restrictive BEM would assume the internalising of guard bands; and
- setting a default frame structure.

7.336 In addition, ComReg recognises that default technical parameters for synchronisation should not represent a significant constraint for any one operator. Therefore, based on its analysis above, ComReg considers TD-LTE configuration 2 (3:1) with special sub frame (SSF) option 6 to be the optimal default frame structure for use with permissive masks. Alternative frame structures whose transmit and receive periods are aligned with this configuration would also be permitted to use the permissive mask.

7.337 Any other configuration that is not compatible with TD-LTE configuration 2 SSF option 6 would still be permitted, however its implementation would be subject to the restrictive BEM and would be obliged to not cause interference to those networks that use the default frame structure (or equivalent).

7.338 Due to the significant challenges of synchronisation and the lower potential for interference of indoor low power small cells, ComReg intends to take a pragmatic approach whereby indoor small cells that operate with an EIRP of less than or equal to 24 dBm per carrier would be exempted from the requirement to synchronise and may use the permissive mask. However in the event that such small cells were to cause interference to other users, then the responsible operators would be required to rectify the interference issues, which may include ensuring synchronisation or EIRP reduction.

7.339 Furthermore, ComReg recognises that with advancements in technology or notable changes in consumer behaviour, the default set of technical parameters set out above and in particular the frame structures may need to change over time. In the event that sufficient demand from operators exists to change any of the parameters above, operators should first agree on which parameters they wish to change, before notifying ComReg of their desire to make changes.

7.340 ComReg would then carry out a review of the proposed changes. Provided the proposed changes do not cause interference to other operators, ComReg would revise the inter-operator synchronisation procedure and notify all licensees of the change. The inter-operator synchronisation procedure forms part of the conditions for all licences. Any changes to this procedure will be reflected in operators' licences for the 2.3 GHz and the 2.6 GHz TDD band.

Chapter 8

8 Transition arrangements and preparatory licences

- 8.1 “Transition” refers to the activities required from existing and new licensees to adjust their networks to comply with the outcome of a spectrum award process.
- 8.2 Transition processes are a normal activity in respect of bands that have been previously licensed and were, for example, a feature of the 2012 MBSA²⁹⁶ in respect of the 900 MHz and 1800 MHz bands.

8.1 Summary of ComReg’s view in Document 19/59R

8.1.1 2.1 GHz Time Slice 1 Transition

- 8.3 Section 9.1 of Document 19/59R discussed the potential need for transition arrangements for the 2.1 GHz Band in advance of the commencement date for Time Slice 1 in that band (“2.1 GHz Time Slice 1 Transition”).

The potential need for a 2.1 GHz Time Slice 1 Transition

- 8.4 ComReg noted that transition arrangements may be needed for the 2.1 GHz Band as any new spectrum rights of use for the 2.1 GHz Band may be different, in terms of frequency location and/or quantum of spectrum, to the 2.1 GHz spectrum rights of use of existing licensees (and any interim spectrum rights of use that may be granted as discussed in Chapter 5 and Annex 5 of Document 19/59R).

Potential transition scenarios for 2.1 GHz Time Slice 1 Transition

- 8.5 At the macro level, ComReg noted that there are three potential transition scenarios based on different award outcomes:
- **Transition Scenario A:** An existing licensee wins an equal or greater amount of new spectrum rights in the 2.1 GHz Band in Time Slice 1 but these spectrum rights are in a different frequency location in the band. This scenario could apply to all existing licensees in the 2.1 GHz Band;
 - **Transition Scenario B:** An existing licensee wins a reduced amount of new spectrum rights in the 2.1 GHz Band in Time Slice 1. These rights could be in the same frequency location or in a different frequency

²⁹⁶ See Annex 11 of Document 19/59R for a summary of transition in the 2012 MBSA.

location in the band. This scenario would not apply to Meteor as it will maintain 2x15 MHz of spectrum rights in Time Slice 1 under its existing 3G licence; and

- Transition Scenario C: An existing licensee does not win any new spectrum rights in the 2.1 GHz Band in Time Slice 1. This scenario would not apply to Meteor as it will maintain 2x15 MHz of spectrum rights in Time Slice 1 under its existing 3G licence.

The potential transition timings required

- 8.6 While ComReg noted that the complexity and potential transition times required for each of the above transition scenarios would depend on the specific details of the transition, ComReg provided some general observations informed by the 2012 MBSA transition.
- 8.7 Overall ComReg observed that while there are similarities to the 2012 MBSA there are also some important differences²⁹⁷ which suggest that the 2.1 GHz Time Slice 1 Transition has a **reduced potential for service disruption** and is **likely to be less complex and less time consuming** than the transition for the 2012 MBSA, particularly for Transition Scenarios B and C.
- 8.8 While noting that it will only be possible to specify precise transition timings for each scenario following the outcome of the Proposed Award, ComReg observed that for:
- Transition Scenario A, a maximum time period of 4 to 5 months would likely represent a “worst case” timeframe, although this transition could be somewhat complicated by the fact that all spectrum rights in the 2.1 GHz Band are currently assigned;
 - Transition Scenario B, a period of up to 2 years would likely represent a “worst case” timeframe, noting in particular the lower potential for disruption to end-consumer services compared to the 2012 MBSA; and
 - Transition Scenario C, no “worst case” timing advice was provided. Instead, ComReg proposed to address setting timeframes for this transition following the outcome of the Proposed Award when the pertinent facts became available.

ComReg’s proposals – 2.1 GHz Time Slice 1 Transition

- 8.9 Overall, the aim of these transition proposals is to facilitate a timely and orderly transition to the outcome of the Proposed Award, while mitigating disruption to

²⁹⁷ See paragraphs 9.10 and 9.11 of ComReg Document 19/59R.

operators and consumers.

8.10 In light of certain similarities between the 2.1 GHz Time Slice 1 Transition and the 2012 MBSA transition (and the successful implementation of the latter), ComReg's proposals for the 2.1 GHz Time Slice 1 Transition draws from the approach adopted in the 2012 MBSA.

8.11 ComReg's 2.1 GHz Time Slice 1 Transition proposals therefore included:

1. an obligation that all participants (including existing licensees) in the Proposed Award would agree to abide by the transition rules;
2. the potential collection of information from existing licensees to inform ComReg's transition proposals, transition rules and transition plans;
3. the setting of transition rules by which to formulate a transition plan, consisting of:
 - defining the elements to be included in a transition plan (see paragraph 9.31 of Document 19/59R);
 - defining the process to determine a transition plan (see paragraphs 9.32 and 9.33 of Document 19/59R); and
 - including provisions to account for the potential for delays to the commencement date of new spectrum rights in Time Slice 1 and the acceptance of liquidated damages in the event of non-compliance with any final transition plan (see paragraphs 9.34 to 9.35 of Document 19/59R); and
4. the implementation of the transition plan, including appropriate licensing arrangements to facilitate same, for example interim licences for transition purposes (see paragraphs 9.36 to 9.40 of Document 19/59R).

8.1.2 Time Slice 2 Transition

8.12 Section 9.2 of Document 19/59R discussed the potential need for transition arrangements in advance of the commencement date for Time Slice 2 (the "Time Slice 2 Transition") in respect of the 2.1 GHz, 2.3 GHz and 2.6 GHz bands.

The potential need for transition

- 8.13 ComReg noted that it is proposing specific provisions for the assignment round of the Proposed Award to eliminate the need for transition between Time Slice 1 and Time Slice 2 *in certain circumstances*²⁹⁸. However, it also noted that a Time Slice 2 Transition may nevertheless be required where any new rights of use won by a winning bidder in the 2.1 GHz, 2.3 GHz and/or 2.6 GHz bands for Time Slice 2 are different, in frequency location and/or quantum of spectrum, to the spectrum rights in those band(s) won by same bidder in Time Slice 1.

ComReg's proposals

- 8.14 ComReg proposed to implement measures in respect of use in 2.1 GHz, 2.3 GHz and 2.6 GHz bands for Time Slice 2 similar to those proposed in relation to the 2.1 GHz Time Slice 1 Transition.
- 8.15 While noting that it is not possible to provide greater specificity on transition until the outcome of the Proposed Award is known and closer to the commencement date of 12 March 2027 for Time Slice 2, ComReg considered it helpful to provisionally identify timeframes by which it would seek transition proposals from winning bidders and existing licensees, being:
- one year in advance of 12 March 2027 for Transition Scenario A;
 - two years in advance of 12 March 2027 for Transition Scenario B; and
 - three years in advance of 12 March 2027 for Transition Scenario C.

8.1.3 Eir 2.3 GHz Transition

- 8.16 Section 9.3 of Document 19/59R discussed the potential need for transition arrangements in respect of Eir's RurTel network in the 2.3 GHz Band ("Eir 2.3 GHz Transition") and ComReg's then current thinking on transition proposals.

The potential need for transition

- 8.17 Noting the background information on the RurTel network (presented in section 6.2.3 of Document 19/59R) and the potential scenarios for Eir to migrate its RurTel network from the 2.3 GHz Band (discussed in Chapter 7 of Document 19/59R), ComReg noted that the RurTel network may not be fully migrated from the 2.3 GHz band in advance of the Proposed Award, and it would therefore be

²⁹⁸ As discussed in Chapter 7 of Document 19/59R, ComReg proposed to include a provision in the assignment round where winning bidders who win the same amount of spectrum in a spectrum band in both time slices would only be provided spectrum assignment options with contiguous spectrum assignments across the two time slices (i.e. no transition between the two time slices would be required).

appropriate to consider transition arrangements for same.

Background 3.6 GHz Award Transition Framework

- 8.18 ComReg observed that there are some similarities between the situation currently faced in respect of the RurTel network in the 2.3 GHz Band and that faced by ComReg concerning the then existing FWALA licensees in the 3.6 GHz Band in the context of its 3.6 GHz Award.
- 8.19 In this regard, ComReg presented summary information on the 3.6 GHz Award transition framework, noting:
- the four principles underpinning the framework (see paragraph 9.50 of Document 19/59R and paragraph 8.21 below); and
 - the three transition tools used, being:
 - the formulation of a transition plan, based on transition rules;
 - assigning a Transition Protected Licence (“TPL”) to winning bidders in the award should transition activities be required beyond the expiry of the FWALA licences on 31 July 2017; and
 - allowing an existing licensee (whether or not it won rights of use in the award), under certain pre-conditions, to obtain a Transition Unprotected Licence (“TUL”).

ComReg’s then current thinking - Eir 2.3 GHz Transition

The transition principles

- 8.20 Considering the nature of the services provided by the RurTel network (i.e. voice services to customers in rural areas that do not currently have an alternative fixed telephony service) and observing the similarities of this service provision to that of the existing licensees in the 3.6 GHz Band, ComReg noted that the four principles underpinning the 3.6 GHz transition framework would also appear to be relevant to the Eir 2.3 GHz Transition:
- minimise the potential for disruption to existing consumer services;
 - introduce new rights of use in the 2.3 GHz Band as soon as possible without unnecessarily delaying the delivery of future liberalised services;
 - maximise benefits to end-users; and
 - ensuring the efficient use of spectrum during the Transition period.

Potential tools and measures (per Eir migration scenario)

- 8.21 In the event of a **full migration by Eir** sufficiently in advance of the Proposed Award (or sufficient certainty that this would occur before the commencement date of new rights in the band) or in the event that Eir wins the 2300 - 2330 MHz frequency specific-lot²⁹⁹, ComReg observed that there would be no need to consider Transition arrangements for the Eir 2.3 GHz network.
- 8.22 In the event of **no further migration by Eir** in advance of the Proposed Award (or insufficient certainty concerning any further migration before the commencement of new rights in the band) and assuming that Eir does not win new rights in the 2300 - 2330 MHz frequency specific-lot, ComReg observed that, given its objective to promote the interests of users (including by ensuring that all users have access to a universal service), transitional measures would appear justified to ensure that existing RurTel customers³⁰⁰ can continue to access voice services.
- 8.23 In that regard, ComReg proposed to:
- continue to license the RurTel network under the existing licensing framework³⁰¹ up until the commencement date of new rights of use in the 2.3 GHz Band. That is, where ComReg would not renew or extend Eir's existing rights in the band beyond this date³⁰²; and
 - implement a transitional licensing framework for the RurTel network whereby Eir would be provided an option, upon proper application (including payment of appropriate fees) to obtain sufficient transitional rights of use in the 2.3 GHz Band for a limited period of time and subject to various conditions.
- 8.24 In terms of the general scope of any such transitional rights, ComReg envisaged that:
- such transitional rights would be on a protected basis;

²⁹⁹ Should Eir win this frequency-specific lot, then a transition licence would not be required as the continued operation of the RurTel network would be facilitated under the new spectrum rights issued to Eir.

³⁰⁰ i.e. those customers remaining on the RurTel network at the time of the commencement of new rights, noting the potential for sufficiently comparable voice services to be provided in the intervening period by Eir on an alternative platform/s or by alternative providers.

³⁰¹ See, in particular:

- the Wireless Telegraphy (Radio Link Licence) Regulations ([S.I No. 370 of 2009](#)); and
- ComReg's guidelines for fixed-link licences: *Guidelines to Applicants for Point to Point Radio Link Licences*, [ComReg Document 09/89R2](#).

³⁰² See footnote 729 of Document 19/59R for ComReg's observations on the considerable discretion afforded to it under the existing licensing framework for RurTel.

- technical conditions similar to those currently in place would apply;
- the frequency assignment and geographic scope would be varied by ComReg as necessary; and
- there would be a clear end-date for all transitional rights. ComReg observed that based on current information and noting the rural locations of the existing customers, this could be informed by the ability of the RurTel customers to avail of the services that would be provided via the NBP.

8.25 ComReg also noted that it would appear appropriate to make the grant of any new transitional rights to Eir conditional upon it agreeing to appropriate measures that would ensure that it would, and had real incentives to, migrate its RurTel customers to an alternative platform/s in a timely, efficient and orderly manner. In that regard, ComReg observed that such measures/conditions could reflect those proposed in respect of the 2.1 GHz Time Slice 1 Transition, being:

- an obligation on Eir to abide by the transition rules (including that it will undertake all reasonable and timely measures to migrate the remaining active customers of RurTel to an alternative Eir platform/s);
- the collection of information from Eir to inform ComReg's transition proposals, transition rules and transition plan;
- Eir being obliged to provide, as soon as practicable following the Proposed Award, a "transition plan proposal" to ComReg setting out, in detail, its proposed transition plan (with milestones etc.);³⁰³
- the setting of transition rules by which to formulate a transition plan; and
- the implementation of the transition plan.

8.26 In relation to the spectrum fees for any transitional right of use, and noting the power to impose fees which reflect the need to ensure the optimal use of the radio frequency spectrum, ComReg envisaged setting spectrum fees based on the higher of:

³⁰³ For example:

- setting out in detail its proposed migration steps (i.e. key transition activities);
- the setting of milestone dates for each transition activity identified;
- a robust and transparent mechanism to allow ComReg (including any of its agents or servants), Winning Bidders and other interested parties to monitor compliance with the Transition Activity milestones and deliverable dates.

- the existing fees set out in the Wireless Telegraphy (Radio Link Licence) Regulations (S.I No. 370 of 2009) but updated to present day prices using the overall CPI; or
- the opportunity cost of the RurTel network remaining in the band beyond the commencement of new rights in the band. For example, and assuming a frequency-specific lot for the relevant frequencies, by reflecting the difference between the final prices for any frequency-specific lot and frequency-generic lots in the 2.3 GHz band (or a reasonable approximation of same given the proposed combinatorial nature of the auction proposed).

8.27 In the event of a **partial migration by Eir** in advance of the Proposed Award, ComReg observed that:

- the transitional framework identified in respect of no migration above would, in general terms, also be required for those areas not migrated; and
- certain specific measures (e.g. fees) identified above in respect of no migration may need to be suitably adapted depending on the level of migration and the impact upon the Proposed Award. For example, if sufficient migration occurred so as to not warrant a frequency-specific lot for the relevant frequencies.

8.1.4 Preparatory Licences

8.28 Section 9.4 of Document 19/59R set out ComReg's proposals to make preparatory licences available to all winning bidders in the Proposed Award. This would facilitate winning bidders in carrying out preparations to their network to install or test equipment in advance of the commencement date of any new licences issued. However, such licences would not allow any wireless telegraphy transmissions.

8.29 ComReg proposed that winning bidders would be able to apply for a preparatory licence following the completion of the Proposed Award and that these licences would operate until the commencement date of new licences.

8.30 In addition, ComReg noted that, should a winning bidder wish to test or trial its network or a service in advance of the commencement of its spectrum rights, winning bidders could also apply for a Test or Trial licence³⁰⁴.

³⁰⁴ See www.testandtrial.ie

8.2 Views of respondents to Document 19/59R

8.2.1 Transition

- 8.31 Three respondents (Eir, Three and Vodafone) provided views on the proposed transition arrangements discussed in Document 19/59R.
- 8.32 Eir notes that ComReg's approach to the 2.1 GHz Time Slice 1 Transition is informed by the 2012 MBSA and it agrees that the 2012 MBSA transition worked well. Eir believes that this is because all existing MNOs in the 900 MHz and 1800 MHz bands acquired spectrum rights, in part facilitated by appropriate spectrum caps, which mitigated the risk that the customers of one or more MNOs would face disruption. In this regard, Eir believes that a band specific spectrum cap for the 2.1 GHz band is required if all of the band is to be auctioned. This proposal and ComReg's assessment is discussed Chapter 6 of this document, and ComReg does not propose to impose such a cap in the Proposed Award.
- 8.33 In addition, Eir submitted a view on 3.6 GHz transition (when commenting on the liberalisation of 3G licences - see Chapter 4 of this document) stating that there is *"ongoing unacceptable delays to access the 3.6 GHz licences"*.
- 8.34 Three stated that transition processes, if any, should favour and support the new spectrum licensee that is willing to develop the market, and not the existing spectrum licensee who may only want to "sweat" their existing old assets.
- 8.35 Three added that ComReg should avoid the approach taken for the 3.6 GHz spectrum award, where Three contends that *"outgoing licensees hold priority over new ones"*.
- 8.36 Vodafone agreed that transition in the 2012 MBSA worked well, but submits that transition following the 3.6 GHz Award has not worked as well. Vodafone provided observations³⁰⁵ on both of these processes and proposed that:
- ComReg should seek to have equal motivation for all parties to any plan produced;

³⁰⁵ See paragraphs 101 and 102 of Vodafone's submission, where it states that:

- *"In 2012, the transition plan was agreed with 2 months from the end of the auction. (Vodafone wrote to ComReg confirming agreement to the plan 12 Dec 2012)"*
- *"The Plan proposed that all changes were completed in a six-month period, January to June 2013."*
- *"It is now two years past the start date of the [3.6 GHz Band] licenses and we do not have complete Transition or even a complete Transition Plan."*

- ComReg should strictly define the time to produce a transition plan as part of the award process; and
- the time for execution of the transition plan should also be defined. Vodafone submits that *“there appears to be no reason why this period should be longer than one year”*.

Vodafone’s specific comments on transition

8.37 In relation to ComReg’s specific proposals, Vodafone submits that for the:

- 2.1 GHz Time Slice 1 Transition (Section 9.1), ComReg should commit to produce a transition plan in a defined time, which it believes to be 4-5 months maximum;
- Time Slice 2 Transition (Section 9.2), ComReg must commit to produce a plan in a defined time; and
- Eir 2.3 GHz Transition, an open-ended transition in respect of RurTel is unacceptable.

8.2.2 Preparatory Licences

8.38 No respondent commented on ComReg’s preparatory licence proposals.

8.3 Updated information on the 3.6 GHz Band Transition process

8.39 As Eir, Three and Vodafone each submitted views on the 3.6 GHz Band Transition process, it is first appropriate to set out below some relevant information relating to that process to date. The information provided below also demonstrates each Winning Bidder’s readiness (or lack thereof) to deploy new services in the 3.6 GHz Band following the completion of the 3.6 GHz Band Award.

8.40 Up to date information on the 3.6 GHz Band Transition process can be found on ComReg’s 3.6 GHz Band Transition webpage³⁰⁶. Additionally ComReg has recently published its 3.6 GHz Band Transition Progress Report 2019³⁰⁷. Among other things this information highlights that:

- ComReg has actively engaged with Winning Bidders and existing operators since June 2017 in order to develop and implement

³⁰⁶ See 3.6 GHz Transition webpage on ComReg website (<https://www.comreg.ie/industry/radio-spectrum/spectrum-awards/3-6-ghz-band-transition/>)

³⁰⁷ See ComReg Document 19/115

appropriate Transition Plans, which are progressed and prioritised in particular where Winning Bidders have sufficiently-developed plans to roll-out new services;

- The 3.6 GHz Band Transition licensing framework allows existing operators to continue to use that band to provide services to their customers until such time that Winning Bidders are ready to roll-out commercial services. As noted previously, the principles underpinning this framework can be summarised as follows:
 - minimise the potential for disruption to existing consumer services;
 - introduce liberalised licences as soon as possible without unnecessarily delaying the delivery of future liberalised services;
 - maximise benefits to end users; and
 - ensure the efficient use of spectrum during the Transition period.
- Considerable progress has been made in the orderly transition of the 3.6 GHz Band and this progress has facilitated the commencement of spectrum rights for all new 3.6 GHz Band licensees to varying degrees:
 - As of 2 December 2019, ComReg has commenced 3.6 GHz Band Liberalised Use spectrum rights for 79% of the Lots³⁰⁸ won by Dense Air. Dense Air has not submitted to ComReg a Transition Plan Proposal to develop Localised Transition Plans for the rollout of new services in the remaining Transition Service Areas.³⁰⁹
 - On 1 September 2018, ComReg has commenced 3.6 GHz Band Liberalised Use spectrum rights for 100% of the Lots won by Imagine (i.e. all such Lots in all four Regions).
 - As of 2 December 2019, ComReg has commenced 3.6 GHz Band Liberalised Use spectrum rights for 80% of the Lots won by Meteor. In July 2019, Meteor submitted its Transition Plan Proposal for rollout of new services in the 3.6 GHz Band, and ComReg and Eir has initiated discussions with relevant parties in order to develop appropriate Localised Transition Plans.

³⁰⁸ The 3.6 GHz Band spectrum award consisted of 594 lots spread over nine geographic regions (four rural and five urban), see ComReg Document 17/38 – Information Notice: Results of the 3.6 GHz Band Spectrum Award – published 22 May 2017.

³⁰⁹ Paragraph 3.206 of the 3.6 GHz Band Spectrum Award Information Memorandum (ComReg Document 16/71) states that Winning Bidders and Existing Licensees who have agreed to abide by the Transition Rules are required to formulate Transition Plan Proposals, and to submit them to ComReg.

- As of 2 December 2019, ComReg has commenced 3.6 GHz Band Liberalised Use spectrum rights for 88% of the Lots won by Three. Three has also not submitted to ComReg a Transition Plan Proposal to develop Localised Transition Plans for the rollout of new services in the remaining Transition Service Areas.
- As of 2 December 2019, ComReg has commenced 3.6 GHz Band Liberalised Use spectrum rights for 58% of the Lots won by Vodafone. In addition, ComReg offered to commence another 10% of Vodafone's Lots but this was declined by Vodafone, while another 21% of Vodafone's Lots are no longer refunded in line with paragraph 2.75 of the 3.6 GHz Band Information Notice³¹⁰, as the delayed availability of these Lots has been caused by, or contributed to, by Vodafone not rolling out new services in these Lots in line with the Local Transition Plan agreed on 18 June 2019. In June 2019 following the submission of a Transition Plan Proposal from Vodafone, ComReg implemented Localised Transition Plans for Vodafone's rollout of new services in the 3.6 GHz Band. The Localised Transition Plans required Imagine to complete all its Transition Activities by 5 November 2019, however this date was subsequently extended to 2 February 2020 at the request of Vodafone.

8.4 ComReg's assessment of respondents views

8.41 This section first considers the respondents views on the 3.6 GHz Band Transition process and then considers the respondents views on ComReg's transition proposals for this award.

8.4.1 3.6 GHz Band Transition

8.42 Contrary to Eir's view that there have been "*ongoing unacceptable delays*" to accessing the 3.6 GHz Band, Vodafone's view that the 3.6 GHz Band Transition has not worked well, and Three's submission that ComReg should avoid the approach taken for the 3.6 GHz Spectrum Award where it believes that outgoing/existing licensees were given priority, the facts of the matter as noted above highlight that:

- the principles underpinning the 3.6 GHz Band Transition and the 3.6 GHz Band Transition rules were appropriate for that process, given among other things, that this ensures the continued services for those existing customers who may have been at risk of losing their service while winning bidders prepared for the deployment of their services. In

³¹⁰ Document [16/71](#), 3.6 GHz Band Spectrum Award, Information Memorandum, published 26 August 2016

this regard, ComReg observes that all of the MNOs have taken over two years since completion of the 3.6 GHz Band Award to launch new 5G³¹¹ services in the 3.6 GHz band;

- the 3.6 GHz Band Transition has progressed in line with the principles and rules and no priority was given to outgoing licensees over new licensees;
- the 3.6 GHz Band Transition has worked well, as evidenced from the significant percentage of Lots commenced under 3.6 GHz Band Liberalised Use Licences (see paragraph 8.40 above), and the launch of higher speed FWA³¹² and new 5G services by winning bidders; and
- the timing of the commencement of Lots in 3.6 GHz Band Liberalised Use Licences is determined by the 3.6 GHz Transition process. As outlined below, factors influencing this include the submission of sufficiently-developed transition plans by winning bidders to roll-out services, and the ability of the winning bidders to abide by these plans. In this regard, ComReg notes that:
 - all MNOs have taken circa 2 years or more to submit Localised Transition Plan proposals³¹³; and
 - in a number of Vodafone's Lots, it has not commenced the provision of services because it was not ready to so, rather than due to the presence of an existing licensee.

Further Information on the 3.6 GHz Band Transition process

8.43 ComReg also notes the following:

- i. Prior to the 3.6 GHz Spectrum Award, the 3.6 GHz Band was being used to provide wireless broadband and telephone services to 21,665 customers (at the time of the 3.6 GHz Band Decision) predominantly in rural areas. In these areas the existing operators may have been the only available provider of broadband services to homes and schools.

³¹¹ In September 2019, Vodafone launched commercial 5G services in 5 cities. See [Vodafone Ireland press release of 17 September 2019](#)).

In October 2019, Eir launched commercial 5G services in 10 towns and cities. See <https://www.rte.ie/news/business/2019/1024/1085356-eir-launches-its-5g-network-in-10-towns-and-cities/>

Three has indicated that it is delaying its plans to launch 5G services until 2020. See <https://www.irishtimes.com/business/technology/three-delays-5g-rollout-until-next-year-1.4099752>

³¹² In February 2019, Imagine launched its plans for the commercial rollout of high-speed fixed wireless broadband in regional and rural Ireland. See <https://www.rte.ie/news/business/2019/0213/1029304-imagine-to-bring-high-speed-broadband-to-rural/>)

³¹³ Vodafone submitted its Localised Transition Plan proposals in April. Eir submitted its proposals in July 2019. Three has yet to submit its proposals.

- ii. In order to ensure continued services for those existing customers who were at risk of losing their service while winning bidders prepared (e.g. via trials) for the deployment of their services, ComReg developed a Transition licensing framework which it consulted upon extensively with interested parties and implemented by way of the rules of the 3.6 GHz Spectrum Award which all participants agreed to be bound by. Those rules are contained in the 3.6 GHz Spectrum Award Information Memorandum (ComReg Document 16/71).
- iii. It follows that all participants in the 3.6 GHz Spectrum Award, including winning bidders, understood and accepted that:
 - they would be bidding to acquire rights to 'brownfield' spectrum, which was being used for the provision of wireless broadband services to existing customers in certain parts of the State;
 - ComReg has a general objective to take all reasonable measures aimed at promoting the interests of users, including existing customers; and
 - there was a potential for delayed access to any and all new spectrum rights (or "Lots") in the 3.6 GHz Band, as ComReg expressly put interested parties on notice of this and stipulated that, in submitting an application, applicants acknowledge and accept same.
- iv. The Transition arrangements for the 3.6 GHz Spectrum Award were designed so that consumers could continue to receive broadband services while the winning bidders were planning their network rollout. Once the winning bidders inform ComReg of their plans for each area, ComReg arranges for the spectrum to be cleared in good time to enable the roll out of its network.
- v. While it has taken some winning bidders longer than one might have initially anticipated to finalise their plans to roll out new services, as set out above, a substantial amount of the 3.6 GHz spectrum is available for use by new operators. ComReg continues to engage with all relevant stakeholders in order to clear spectrum in areas where it is required to facilitate the roll out plans of Winning Bidders.
- vi. As can be seen from paragraph 8.40 above, winning bidders were not ready to rollout services in the 3.6 GHz Band directly following the completion of the 3.6 GHz Spectrum Award in 2017. Notably, and despite ComReg requesting in December 2017 that winning bidders submit detailed Transition Plan Proposals to develop Localised Transition Plans, Meteor and Vodafone only submitted their Transition Plan Proposals to ComReg in 2019, while Dense Air and Three have yet to submit Transition Plan Proposals.

8.44 In relation to Vodafone, ComReg notes that Vodafone only submitted its final Transition Plan Proposal to develop Localised Transition Plans for the rollout of new services in April 2019. ComReg subsequently implemented Localised Transition Plans for Vodafone's rollout of ten sites in the 3.6 GHz Band. The Localised Transition Plans required Vodafone to complete all its Transition activities by 5 November 2019. However, Vodafone requested ComReg to extend the date for the completion of transition activities to 2 February 2020. ComReg also notes that while Vodafone could have submitted a Transition Plan Proposal prior to April 2019 it did not do so, indicating that it was not in a position to rollout new services in the 3.6 GHz Band in advance of April 2019.

8.4.2 ComReg's Transition proposals

General comments on Transition

8.45 In relation to Three's view that the Transition processes should favour the new spectrum licensee and not the existing spectrum holder, and Vodafone's view that ComReg should seek to have equal motivation for all parties, ComReg would:

- remind them of the transition principles set out in paragraph 8.21 above and the need to balance the interests of new spectrum licensees with those of existing consumers of services in the band. In that regard, it is also noteworthy that the minimisation of consumer disruption was a transition principle for both the MBSA and 3.6 GHz transitions;
- point out that, it is far from certain that simply favouring new licensees over existing licensees would necessarily ensure the efficient use of spectrum (see, for example, the observations under Section 8.3 above); and
- point out that, whilst the Transition principles and rules for each Transition process are considered on a case by case basis in light of the specific circumstances of each case³¹⁴, ComReg is bound by, amongst other things, its obligations of non-discrimination and proportionality in the design and implementation of those principles and rules.

8.46 While ComReg will of course endeavour to design and implement any Transition process as quickly as possible, it will do so having regard to the above considerations.

³¹⁴ For example, two Transition principles underpinned the 2012 MBSA Transition framework, while four Transition principles underpinned the 3.6 GHz Band Transition framework given its specific circumstances.

- 8.47 With regard to Vodafone's submission that ComReg should strictly define the time required to produce a transition plan, ComReg is of the view that this would not be appropriate as the details and complexities of a Transition will not be known until the award process is complete and this naturally affects the length of time this that would be required to finalise a Transition plan.
- 8.48 Notwithstanding this, ComReg's Transition proposals aim to finalise Transition plan(s) in a timely manner as, among other things, this provides more certainty to all parties.
- 8.49 With regards to Vodafone's further suggestion that the time for execution of the transition plan should also be defined and not be longer than one year, ComReg is of the view that it is not appropriate to set a defined period in advance of knowing the details of the transition, as the timing of a transition will naturally depend on this.
- 8.50 For example, as discussed in Document 19/59R, some transition scenarios (i.e. transition scenario B or C) will likely take longer than others (i.e. transition scenario A). Furthermore, the timeframe to complete some transitions (i.e. transition scenario C) could realistically be longer than the 1 year transition timeframe suggested by Vodafone.

Vodafone's specific comments on transition

(i) 2.1 GHz Time Slice 1 Transition and (ii) Time Slice 2 Transition

- 8.51 ComReg is of the view that it is not appropriate to commit to produce a transition plan in a defined time and within 4-5 months for the 2.1 GHz Time Slice 1 Transition, as the circumstances of each transition, and the type of transition scenario (e.g. A, B or C) will not be known until after the outcome of the award.
- 8.52 Notwithstanding, ComReg's Transition proposals aim to finalise a Transition plan(s) in a timely manner, as among other things, this provides more certainty to all parties.

(iii) Eir 2.3 GHz Transition

- 8.53 With regard to Vodafone's view that an open-ended transition in respect of RurTel is unacceptable, ComReg firstly notes that it did not propose an "open-ended" transition. Instead ComReg proposed transition rules which included the setting of a clear end-date for all transitional rights (see paragraph 8.24 above).
- 8.54 As with all transitions, ComReg will endeavour to complete transition in as timely a manner as possible.

8.5 ComReg's preliminary decision

8.5.1 2.1 GHz Time Slice 1 Transition

- 8.55 In Chapter 4 of this Document ComReg notes that should existing licensees in the 2.1 GHz band be willing to surrender 2.1 GHz rights of use in advance of licence expiry, and if such an approach is subsequently adopted, then this would bring forward the commencement date of Time Slice 1 in the 2.1 GHz Band.
- 8.56 Under this scenario ComReg observes that this would reduce the timeframe for carrying out transition activities, which could increase the potential for delays to the commencement date of new spectrum rights and heighten the potential need for interim licences for transition purposes. This of course depends on the timing and the outcome of the award process, as well as the commencement date selected for new 2.1 GHz spectrum rights.
- 8.57 In relation to the above scenario, ComReg observes that the proposals for the 2.1 GHz Time Slice 1 Transition (see Section 9.1.2 of Document 19/59R) contain appropriate provisions to address such eventualities without need for modification.
- 8.58 Noting this, and ComReg's assessment of respondents' views above, ComReg's preliminary decision is to adopt the Time Slice 1 Transition proposals as set out in Section 9.1.2 of Document 19/59R.

8.5.2 Time Slice 2 Transition

- 8.59 Noting ComReg's assessment of respondents' views above, ComReg's preliminary decision is to adopt Time Slice 2 Transition proposals as set out in Section 9.2 of Document 19/59R.

8.5.3 Eir's 2.3 GHz Transition

- 8.60 In Chapter 5 and 6 of this document information on Eir's RurTel network is set out which, in summary, indicates that:
- while Eir has decommissioned the RurTel network in the Kerry area, it is still active in two areas, Galway and Donegal;
 - while Eir's overall aim is to decommission the RurTel network, it has not indicated an end date or indicated what further migration it plans before the award process; and
 - therefore the three RurTel network migration scenarios remain (no further migration, partial migration and full migration) between now and the award process. In the case of no further migration, a frequency-

specific lot of 30 MHz in the 2300 - 2330 MHz range is proposed, while in the case of partial migration, ComReg's lot proposals will depend on the significance of the partial migration.

- 8.61 From the above, ComReg observes that, while Eir has reduced the extent of the RurTel network in the 2.3 GHz band, this does not materially impact the transition analysis or proposals as set out in Document 19/59R and summarised above, as the relevant circumstances of the RurTel network remain the same. For example, the RurTel network may not be fully migrated from the 2.3 GHz band in advance of the Proposed Award, and it is still being used to provide voice services to customers in rural areas that do not presently have an alternative fixed telephony service.
- 8.62 Noting the above, and ComReg's assessment of respondents' views, ComReg's preliminary decision is to adopt the Eir 2.3 GHz Transition proposals as set out in Section 9.3.2 of Document 19/59R.

8.5.4 Preparatory Licences

- 8.63 ComReg's preliminary decision is to adopt the preparatory licence proposals as set out in Section 9.4 of Document 19/59R.

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Chapter 9

9 Draft Decision

This chapter sets out a draft decision document based on the positions set out by ComReg in the preceding chapters and their supporting annexes.

Decision

1. DEFINITIONS AND INTERPRETATION

1. In this Decision, save where the context otherwise admits or requires:

“1800 MHz Band” means spectrum in the range 1710 – 1785 MHz paired with 1805 – 1880 MHz;

“2.1 GHz Band” means spectrum in the range 1920 – 1980 MHz paired with 2110 – 2170 MHz;

“2.1 GHz Band EC Decision” means European Commission Decision 2012/688/EC³¹⁵;

“2.1 GHz Band Frequency Generic Lot” means a right of use in respect of a 2 x 5 MHz block of spectrum in the 2.1 GHz Band, with the specific frequencies of such Lots being determined in the assignment stage of the competitive selection procedure described herein;

“2.1 GHz Band Interim A Licence” means a licence of the type set out in draft form in Schedule [XX] to the 2.1 GHz Band Interim Licence and Early Liberalisation Regulations;

“2.1 GHz Band Interim B Licence” means a licence of the type set out in draft form in Schedule [XX] to the 2.1 GHz Band Interim Licence and Early Liberalisation Regulations;

“2.1 GHz Band Interim Licence and Early Liberalisation Regulations” means the Wireless Telegraphy [(.....)] Regulations, 202X, as set out in draft form in [Annex XX] to ComReg Document 20/[XX] [FORTHCOMING DRAFT INFORMATION MEMORANDUM];

“2.3 GHz Band” means spectrum in the range 2300 – 2400 MHz;

³¹⁵ Commission Implementing Decision of 5 November 2012 on the harmonisation of the frequency bands 1920 - 1980 MHz and 2110 - 2170 MHz for terrestrial systems capable of providing electronic communications services in the Union.

“2.3 GHz Band ECC Decision” means Electronic Communications Committee Decision 14(02)³¹⁶;

“2.3 GHz Band Fixed Frequency Lot (Lower)” means a right of use in respect of the 1x30 MHz block of spectrum from 2300 – 2330 MHz;

“2.3 GHz Band Fixed Frequency Lot (Upper)” means a right of use in respect of the 1x10 MHz block of spectrum from 2390 – 2400 MHz;

“2.3 GHz Band Frequency Generic Lot” means a right of use in respect of a 1x5 MHz block of spectrum in the range 2330 – 2390 MHz, with the specific frequencies of such Lots being determined in the assignment stage of the competitive selection procedure described herein;

“2.6 GHz Band” means spectrum in the range 2500 – 2690 MHz;

“2.6 GHz Band EC Decision” means European Commission Decision 2008/477/EC³¹⁷;

“2.6 GHz Band FDD Frequency Generic Lot” means a right of use in respect of a 2x5 MHz block of spectrum in the range 2500 – 2570 MHz paired with 2620 – 2690 MHz, with the specific frequencies of such Lots being determined in the assignment stage of the competitive selection procedure described herein;

“2.6 GHz Band TDD Fixed Frequency Lot (Lower)” means a right of use in respect of the 1x5 MHz block of spectrum from 2570 – 2575 MHz;

“2.6 GHz Band TDD Fixed Frequency Lot (Upper)” means a right of use in respect of the 1x5 MHz block of spectrum from 2615 – 2620 MHz;

“2.6 GHz Band TDD Frequency Generic Lot” means a right of use in respect of a 1x5 MHz block of spectrum in the range 2575 – 2615 MHz, with the specific frequencies of such Lots being determined in the assignment stage of the competitive selection procedure described herein;

“3.6 GHz Band” means spectrum in the range 3410 – 3435 MHz and 3475 – 3800 MHz;

“3.6 GHz Band Region” means a regional area of the State specified in Schedule 10 of the Wireless Telegraphy (3.6 GHz Band Licences) Regulations 2016 (S.I. No 532 of 2016);

“700 MHz Duplex” means spectrum in the range 703 – 733 MHz paired with 758 – 788 MHz;

³¹⁶ ECC Decision 14(02) - Harmonised technical and regulatory conditions for the use of the band 2300-2400 MHz for Mobile/Fixed Communications Networks (MFCN).

³¹⁷ Commission Decision of 13 June 2008 on the harmonisation of the 2500-2690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community.

“700 MHz Duplex Frequency Generic Lot” means a right of use in respect of a 2x5 MHz block of spectrum in the 700 MHz Duplex, with the specific frequencies of such Lots being determined in the assignment stage of the competitive selection procedure described herein;

“700 MHz EC Decision” means Decision (EU) 2016/687³¹⁸;

“700 MHz EU Decision” means Decision (EU) 2017/³¹⁹;

“800 MHz Band” means spectrum in the range 791 - 821 MHz paired with 832 – 862 MHz”;

“900 MHz Band” means spectrum in the range 880 – 915 MHz paired with 925 – 960 MHz”;

“Authorisation Regulations” means the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations, 2011 (S.I. No. 335 of 2011);

“Award Spectrum” means 700 MHz Duplex Frequency Generic Lots, 2.1 GHz Band Frequency Generic Lots, 2.3 GHz Band Fixed Frequency Lot (Lower), 2.3 GHz Band Fixed Frequency Lot (Upper), 2.3 GHz Frequency Generic Lots, 2.6 GHz Band FDD Frequency Generic Lots, 2.6 GHz Band TDD Fixed Frequency Lot (Lower), 2.6 GHz TDD Band Fixed Frequency Lot (Upper), and 2.6 GHz Band TDD Frequency Generic Lots;

“Base Price” means the price to be paid by a Winning Bidder for the package of Lots won by it in the main stage of the competitive selection procedure described herein;

“Communications Regulation Act 2002” means the Communications Regulation Act, 2002, (No. 20 of 2002), as amended;

“ComReg” means the Commission for Communications Regulation, established under section 6 of the Communications Regulation Act 2002;

“Existing 2.1 GHz Band Licence” means a licence issued pursuant to the Wireless Telegraphy (Third Generation and GSM Mobile Telephony Licence) Regulations, 2002 (S.I. No 345 of 2002), as amended by the Wireless Telegraphy (Third Generation and GSM Mobile Telephony Licence) (Amendment) Regulations, 2003 (S.I. No 340 of 2003), or the 2.1 GHz Band Interim Licence and Early Liberalisation Regulations, as appropriate;

³¹⁸ Commission Implementing Decision of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union.

³¹⁹ Decision (EU) 2017/899 of the European Parliament and of the Council of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union.

“Existing 2.1 GHz Band Licensee” means a person holding one, or more, Existing 2.1 GHz Licences;

“Existing 2.3 GHz Band Licence” means a licence issued pursuant to the Wireless Telegraphy (Radio Link Licence) Regulations, 2009 (S.I. No. 370 of 2009) by which rights of use are assigned within the frequency range 2307 – 2327 MHz;

“Existing 2.3 GHz Band Licensee” means a person holding one, or more, Existing 2.3 GHz Band Licences;

“Framework Regulations” means the European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011, (S.I. No. 333 of 2011);

“Information Memorandum” means the information memorandum which ComReg intends to publish in due course, and **“Draft Information Memorandum”** means the draft information memorandum published by ComReg on [date] 2020 under ComReg Document Number 20/[XX];

“Lot” means a 700 MHz Duplex Frequency Generic Lot, 2.1 GHz Band Frequency Generic Lot, 2.3 GHz Band Fixed Frequency Lot (Lower), 2.3 GHz Band Fixed Frequency Lot (Upper), 2.3 GHz Band Frequency Generic Lot, 2.6 GHz Band FDD Frequency Generic Lot, 2.6 GHz Band TDD Fixed Frequency Lot (Lower), 2.6 GHz Band TDD Fixed Frequency Lot (Upper), or 2.6 GHz Band TDD Frequency Generic Lot, as the case may be;

“MBSA2 Liberalised Use Licence” means a licence of the type set out in draft form in Schedule [XX] to the MBSA2 Licence Regulations;

“MBSA2 Licence Regulations” means the Wireless Telegraphy [(.....)] Regulations, 202X, as set out in draft form in [Annex XX] to ComReg Document 20/[XX] [forthcoming Draft Information Memorandum];

“MBSA2 Preparatory Licence” means a licence of the type set out in Schedule [XX] to the MBSA2 Licence Regulations;

“MBSA2 Spectrum Lease Licence” means a licence of the type set out in draft form in Schedule [XX] to the MBSA2 Licence Regulations;

“MBSA2 2.1 GHz Band Transition Licence” means a licence of the type set out in Schedule [XX] to the MBSA2 Licence Regulations;

“MBSA2 2.3 GHz Band Transition Licence” means a licence of the type set out in Schedule [XX] to the MBSA2 Licence Regulations;

“Minister” means the Minister of Communications, Climate Action and Environment;

“Qualified Bidder” means an applicant who, following consideration of its application by ComReg, has been informed, in accordance with the requirements of

the Information Memorandum, that its application is compliant and that it is entitled to participate in the competitive selection procedure described herein;

“**RIA**” means Regulatory Impact Assessment;

“**RSP Decision**” means Decision No 243/2012/EU³²⁰;

“**Transitional Licence**” means a MBSA 2.1 GHz Band Transition Licence or a MBSA 2.3 GHz Band Transition Licence;

“**Winning Bidder**” means a Qualified Bidder that wins at least one Lot in the competitive selection procedure described herein; and

“**Wireless Telegraphy Act 1926**” means the Wireless Telegraphy Act, 1926 (No. 45 of 1926), as amended.

2. DECISION-MAKING CONSIDERATIONS

2. In arriving at its decisions in this document, ComReg has had regard to:

- i. the contents of, and the materials and reasoning referred to in, as well as the materials provided by respondents in connection with, the below-listed ComReg documents:
 - a) 14/101 (insofar as relevant to the Award Spectrum)
 - b) 18/60;
 - c) 18/103;
 - d) 19/59R;
 - e) 19/124
 - f) 20/XX [FORTHCOMING DRAFT INFORMATION MEMORANDUM]
 - g) 20/XX [DOCUMENT TO WHICH THE FINAL DECISION WILL BE ATTACHED]
- ii. the consultants’ reports commissioned, and the advice obtained by ComReg, in relation to the subject-matter of the documents and materials listed above;
- iii. the powers, functions, objectives and duties of ComReg, including, without limitation those under and by virtue of:
 - h) the Communications Regulation Act 2002, and, in particular, sections 10, 12 and 13 thereof;

³²⁰ Decision No 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy programme.

- i) the Framework Regulations, and, in particular, Regulations 13, 16 and 17 thereof;
- j) the Authorisation Regulations, and, in particular, Regulations 9, 10, 11, 12, 15, 16, 17, 18(1)(c) and 19 thereof;
- k) the RSPP Decision;
- l) the 2.1 GHz Band EC Decision;
- m) the 2.3 GHz Band ECC Decision;
- n) the 2.6 GHz Band EC Decision;
- o) the 700 MHz EC Decision;
- p) the 700 MHz EU Decision;
- q) Sections 5 and 6 of the Wireless Telegraphy Act, 1926; and
- r) the applicable Policy Directions made by the Minister under section 13 of the Communications Regulation Act 2002,

and, noting that it has:

- s) given all interested parties the opportunity to express their views and make their submissions in accordance with Regulation 11 of the Authorisation Regulations and Regulation 12 of the Framework Regulations; and
- t) evaluated the matters to be decided, in accordance with ComReg's RIA Guidelines (ComReg Document 07/56a) and the RIA Guidelines issued by the Department of An Taoiseach in June, 2009,

as set out in the various chapters of Document 20/XX [document to which the final decision will be attached] and their supporting annexes.

3. DECISIONS

- 3. Having had regard to the above considerations, ComReg has decided:
 - 3.1 to proceed with the proposed release of the Award Spectrum;
 - 3.2 subject to obtaining the consent of the Minister to the making of the 2.1 GHz Band Interim Licence and Early Liberalisation Regulations, to make those regulations under section 6 of the Wireless Telegraphy Act 1926, prescribing relevant matters in relation to a 2.1 GHz Band Interim A Licence, a 2.1 GHz Band Interim B Licence and Existing 2.1 GHz Band Licences, including prescribing the form of the licences concerned, their duration and the conditions and restrictions subject to which they are granted;

- 3.3 under section 5 of the Wireless Telegraphy Act 1926, and pursuant to the 2.1 GHz Band Interim Licence and Early Liberalisation Regulations, and upon application properly being made to it and payment of the relevant fee/s in accordance with the terms of the 2.1 GHz Band Interim Licence and Early Liberalisation Regulations, to grant Three Ireland (Hutchison) Limited a limited number of individual rights of use for radio frequencies, by way of a 2.1 GHz Band Interim A Licence and/or a 2.1 GHz Band Interim B Licence, in respect of the 2.1 GHz Band;
- 3.4 under Regulation 15 of the Authorisation Regulations, and pursuant to the 2.1 GHz Band Interim Licence and Early Liberalisation Regulations, and:
 - 3.4.1 upon application properly being made to it by an Existing 2.1 GHz Band Licensee with existing 2.1 GHz Band rights of use expiring on or before 15 October 2022, to amend its Existing 2.1 GHz Band Licence/s as appropriate to comply with the 2.1 GHz EC Decision for the period until 15 October 2022 (“Early Liberalisation Option 1”); and
 - 3.4.2 upon application properly being made to it by an Existing 2.1 GHz Band Licensee with existing 2.1 GHz Band rights of use expiring after 15 October 2022 and the payment of the relevant fee (if required), or a binding commitment from Existing 2.1 GHz Band Licensee to pay the relevant fee, as more particularly described in Chapter [XX] of Document 20/XX [document to which the final decision will be attached] and which will be further particularised in the Information Memorandum, to amend its Existing 2.1 GHz Band Licence as appropriate to comply with the 2.1 GHz Band EC Decision for the period until 11 March 2027 (“Early Liberalisation Option 2”);
- 3.5 subject to obtaining the consent of the Minister to the making by it of the MBSA2 Licence Regulations, to make those regulations under section 6 of the Wireless Telegraphy Act 1926, prescribing relevant matters in relation to MBSA2 Liberalised Use Licences, MBSA2 Preparatory Licences, MBSA2 Spectrum Lease Licences, MBSA2 2.1 GHz Transition Licences, and MBSA2 2.3 GHz Transition Licences, including prescribing the form of the licences concerned, their duration and the conditions and restrictions subject to which they are granted;
- 3.6 under section 5 of the Wireless Telegraphy Act 1926, and upon application being properly made to it and payment of the relevant fee/s in accordance with the Information Memorandum and the MBSA2 Licence Regulations, to grant a limited number of individual rights of use for radio frequencies, by way of MBSA2 Liberalised Use Licences and MBSA2 Preparatory Licences in respect of the Award Spectrum;

- 3.7 to implement band plans, including the relevant guard band/s, for each of the 700 MHz Duplex, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands as identified in Annex A to this decision instrument;
- 3.8 to attach conditions to rights of use to a 2.1 GHz Band Interim A Licence and 2.1 GHz Band Interim B Licence as generally described in Chapter [XX] of Document 20/XX [document to which the final decision will be attached] and which will be further particularised in the 2.1 GHz Band Interim Licence and Early Liberalisation Regulations;
- 3.9 to attach conditions to rights of use to Transitional and Preparatory Licences as generally described in Chapter [XX] and Annex [XX] of Document 20/XX [document to which the final decision will be attached] and which will be further particularised in the MBSA2 Licence Regulations;
- 3.10 to attach conditions to rights of use to the Award Spectrum as generally described in Chapter [XX] of Document 20/XX [document to which the final decision will be attached] and which will be further particularised in the MBSA2 Licence Regulations;
- 3.11 to select those parties who will be eligible to be granted MBSA2 Liberalised Use Licence(s) and MBSA2 Preparatory Licence(s) by means of a competitive selection procedure which is more particularly described in Chapter [XX] of Document 20/XX [document to which the final decision will be attached] and which will be further particularised in the Information Memorandum;
- 3.12 to make rights of use in respect of the Award Spectrum available on a national basis;
- 3.13 to make rights of use in respect of the 700 MHz Duplex, 2.3 GHz and 2.6 GHz Bands available for a maximum term of 20 years and where all such rights of use shall expire absolutely on [30 November 2040] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum)³²¹;
- 3.14 to make rights of use in respect of the 2.1 GHz Band, with the exception of the 2.1 GHz Band Interim A Licence and 2.1 GHz Band Interim B Licence, available for a maximum term of [approximately 18 years and 1.5 months] and where all such rights of use shall expire absolutely on [30 November 2040] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum)³²²;

³²¹ Any delay to the commencement of MBSA2 Liberalised Use Licences due to Transitional Licences shall not affect this expiry date.

³²² Any delay to the commencement of MBSA2 Liberalised Use Licences due to Transitional Licences shall not affect this expiry date.

3.15 to incorporate into the competitive selection procedure, *inter alia*, the following elements:

- 3.15.1 a number of stages including an application stage, a qualification stage, a main stage and an assignment stage, with the outcome of the qualification stage determining whether the procedure moves directly to the assignment stage due to demand not exceeding supply, or whether the main stage is necessary, due to demand exceeding supply;
- 3.15.2 the main stage, if it occurs, comprising of a combinatorial clock auction;
- 3.15.3 700 MHz Duplex Frequency Generic Lots being made available in one temporal period from [1 December 2020] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum) to [30 November 2040] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum);
- 3.15.4 2.3 GHz Band Fixed Frequency Lot (Lower), 2.3 GHz Band Fixed Frequency Lot (Upper), 2.3 GHz Band Frequency Generic Lots, 2.6 GHz Band FDD Frequency Generic Lots, 2.6 GHz Band TDD Fixed Frequency Lot (Lower), 2.6 GHz Band TDD Fixed Frequency Lot (Upper) and 2.6 GHz Band TDD Frequency Generic Lots being made available in two “time slices”, viz:
 - i. Time Slice 1: From [1 December 2020] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum) to [11 March 2027] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum); and
 - ii. Time Slice 2: From [12 March 2027] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum) to [30 November 2040] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum);
- 3.15.5 2.1 GHz Band Frequency Generic Lots being made available in two “time slices”, viz:

- i. 2.1 GHz Band Time Slice 1: From [16 October 2022] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum) to [11 March 2027] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum); and
 - ii. Time Slice 2: From [12 March 2027] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum) to [30 November 2040] (or such other date as may be specified by ComReg in, or in accordance with, the Information Memorandum);
- 3.15.6 in the event of the main stage of the auction proceeding, multiple clock primary rounds, with the auctioneer setting the price in each round for each lot category specified in the Information Memorandum, with Qualified Bidders entitled to bid, subject to detailed rules to be set out in the Information Memorandum, for packages of Lots at those prices, until supply equals or exceeds demand across all lot categories at the round prices or for such other reason as may be set out in the Information Memorandum;
- 3.15.7 following any such primary rounds, a single, sealed-bid, supplementary round, entitling Qualified Bidders to submit a number of bids for packages of Lots for which such Qualified Bidders are eligible to bid, at bid prices of their choosing, all of which will be subject to detailed rules set out in the Information Memorandum.
- 3.15.8 Winning bids will be determined by selecting at most one bid from amongst the entirety of bids made by each Qualified Bidder in order to maximise the total value of winning bids subject to not allocating more Lots than available. A price calculation methodology as set out in the Information Memorandum will then be applied to calculate the Base Price on the basis of the opportunity cost of awarding Lots to each Winning Bidder;
- 3.15.9 an assignment stage in which:
 - i. Winning Bidders will be required to participate (other than in respect of 2.3 GHz Band Fixed Frequency Lot (Lower), 2.3 GHz Band Fixed Frequency Lot (Upper), 2.6 GHz Band TDD Fixed Frequency Lot (Lower), and 2.6 GHz Band TDD Band Fixed Frequency Lot (Upper)) and in which each Winning bidder can bid for its preferred option/s out of a range of assignment option/s for which it is eligible to bid, such eligibility being determined by the detailed rules set out in the Information Memorandum;

- ii. All Existing 2.1 GHz Band Licensees will be required to participate to determine the location of their existing 2.1 GHz Band rights of use in Time Slice 1. ComReg will reimburse any reasonable and vouched costs associated with the relocation of existing 2.1 GHz Band rights of use required as a result of the assignment stage which an Existing 2.1 GHz Band Licensee can demonstrate to ComReg's satisfaction which would not otherwise have been incurred;
- 3.15.10 winning bids and prices in the assignment stage which are determined in accordance with the winner and price determination methodology set out in the Information Memorandum;
- 3.15.11 spectrum caps, which will apply to each Qualified Bidder in the competitive selection procedure, and only for the duration of that procedure, as follows:
- i. 70 MHz (unpaired) in aggregate across the 700 MHz Duplex, 800 MHz and 900 MHz Bands, taking into account all existing holdings in these bands at the time of the procedure; and
 - ii. 375 MHz (unpaired) in aggregate across the 700 MHz Duplex, 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz, 2.3 GHz, 2.6 GHz and 3.6 GHz Bands, taking into account all existing holdings in these bands at the time of the procedure (with the exception of existing holdings in the 2.3 GHz Band and, in the case of 3.6 GHz Band holdings, the highest holding in any 3.6 GHz Band Region held by that Qualified Bidder), in each of Time Slice 1 and 2;
- 3.15.12 reserve prices and spectrum usage fees (SUFs) for the MBSA2 Liberalised Use Licences described herein, to be determined in accordance with the methodology referred to in Chapter [XX] of Document 20/XX [document to which the final decision will be attached] and with the [Benchmarking Report] prepared by DotEcon and which accompanies Document 20/[XX] [document to which the final decision will be attached], where the final reserve prices and SUFs will be set out in the Information Memorandum, taking account of any additional relevant data at that time;
- 3.15.13 to require all applicants for a MBSA2 2.1 GHz Band Transition Licence and/or a MBSA2 Band 2.3 GHz Band Transition Licence to abide by the transition rules as set out in the Information Memorandum;

- 3.15.14 to develop and finalise a transition plan/s in consultation with interested parties in accordance with the transition rules which are more particularly described in Chapter [XX] of Document 20/XX [document to which the final decision will be attached] and which will be further particularised in the Information Memorandum;
- 3.15.15 to provide reimbursement of a pro rata proportion of the upfront fee (as determined by the competitive selection process in accordance with the rules set out in the Information Memorandum) and SUFs to a Winning Bidder in the event that the commencement of the rights of use held under its MBSA2 Liberalised Use Licence is delayed as a result of delayed availability of spectrum to which the Licence relates due to circumstances described in the Information Memorandum, including the transition activities of applicable licensees under a transition plan/s;
- 3.15.16 upon application properly being made to it by Winning Bidders in accordance with the terms of the Information Memorandum and the MBSA2 Licence Regulations, the latter as made following the obtaining of Ministerial consent, and on payment of the fees prescribed thereby, to grant MBSA2 Liberalised Use Licences and MBSA2 Preparatory Licences to Winning Bidders, under section 5 of the Wireless Telegraphy Act 1926 for the periods, and subject to the conditions and restrictions (including conditions as to revocation), prescribed in the MBSA2 Licence Regulations, including, as appropriate, the schedules to MBSA2 Liberalised Use Licences and MBSA2 Preparatory Licences as currently set out in Annex [XX] of Document 20/[XX] [Draft Information Memorandum];
- 3.16 upon application properly being made to it by Existing 2.1 GHz Band Licensees in accordance with the terms of the Information Memorandum and the MBSA2 Licence Regulations, to consider granting a MBSA2 2.1 GHz Band Transition Licence to such persons in accordance with the positions as set out in Chapter [XX] of Document 20/[XX] [document to which the final decision will be attached], the Information Memorandum and the transition plan;
- 3.17 upon application properly being made to it by Existing 2.3 GHz Band Licensees within the terms of the Information Memorandum and the MBSA2 Licence Regulations, to consider granting a MBSA2 2.3 GHz Band Transition Licence to such persons in accordance with the positions as set out in Chapter [XX] of Document 20/[XX] [document to which the final decision will be attached], the Information Memorandum and the transition plan;

- 3.18 upon application properly being made to it in accordance with the procedures specified by ComReg under Regulation 19 of the Framework Regulations, to consider granting a MBSA2 Spectrum Lease Licence; and
- 3.19 to retain its discretion regarding how it might treat any unsold Lots depending on the factual circumstances arising from the competitive selection procedure described herein, save for the decision that unsold Lots will not be considered for assignment for a reasonable period after the process, and, in any event, will not be considered for a period of at least 2 years after the award process.

4. STATUTORY POWERS NOT AFFECTED

- 4.1 Nothing in this document shall operate to limit ComReg in the exercise of its discretions or powers, or the performance of its functions or duties, or the attainment of objectives under any laws applicable to ComReg from time to time.

[NAME]

COMMISSIONER

THE COMMISSION FOR COMMUNICATIONS REGULATION

THE [DAY] DAY OF [MONTH] [YEAR]

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Chapter 10

10 Submitting comments and next steps

10.1 Submitting Comments

- 10.1 ComReg invites views from interested parties on all aspects of the Proposed Award over the next 7 weeks and by 10 February at 12 noon. Recognising that this consultation spans the Christmas period, and that the mobilisation of resources may be challenging during this time, ComReg has provided an additional three weeks over the normal four outlined in ComReg's Consultation Procedures³²³.
- 10.2 It would assist the analysis of responses received if comments were referenced to the relevant section / paragraph number in each chapter and annex in this document or the relevant accompanying consultant's report.
- 10.3 Please also set out your reasoning and all supporting information for any views expressed.
- 10.4 Responses must be submitted in written form (post or e-mail) to the following recipient, clearly marked — "Submissions to ComReg 19/124":

Mr. Joseph Coughlan
Commission for Communications Regulation
One Dockland Central
Guild Street
Dublin 1
D01 E4X0.
Ireland

Email: marketframeworkconsult@comreg.ie

- 10.5 We request that electronic submissions be submitted in an unprotected format so that they can be readily included in the ComReg submissions document for

³²³ Document 11/34

electronic publication.

- 10.6 ComReg appreciates that respondents may wish to provide confidential information if their comments are to be meaningful. In order to promote openness and transparency, ComReg will publish all respondents' submissions to this consultation, as well as all substantive correspondence on matters relating to this document and consultation process, subject to the provisions of its guidelines on the treatment of confidential information³²⁴.
- 10.7 Respondents should submit views in accordance with the instructions set out below. When submitting a response to this consultation that contains confidential information, respondents must choose one of the following options:
- A Submit both a non-confidential version and a confidential version of the response. The confidential version must have all confidential information clearly marked and highlighted in accordance with the instruction set out below. The separate non-confidential version must have actually redacted all items that were marked and highlighted in the confidential version.
- OR
- B Submit only a confidential version and ComReg will perform the required redaction to create a non-confidential version for publication. With this option, respondents must ensure that confidential information has been marked and highlighted in accordance with the instructions set out below. Where confidential information has not been marked in accordance with the instructions below, then ComReg will not create the non-confidential redacted version and the respondent will be required to provide the redacted non-confidential version in accordance with option A above.
- 10.8 For ComReg to perform the redactions under Option B above, respondents must mark and highlight all confidential information in their submission as follows:
- a) Confidential information contained within a paragraph must be highlighted with a chosen particular colour;
 - b) Square brackets must be included around the confidential text - one at the start and one at the end of the relevant highlighted confidential information; and
 - c) A scissors symbol (Symbol code: Wingdings 2:38) must be included after the first square bracket. For example, "Redtelecom has a market share of [✂ 25%]."

³²⁴ Document 05/24, "Guidelines on the treatment of confidential information", published on 23 March 2005, available at <https://www.comreg.ie/csv/downloads/ComReg0524.pdf>.

10.2 Next Steps

- 10.9 ComReg intends to publish in the spring of 2020 a draft Information Memorandum outlining in detail the processes and procedures it currently envisages employing when implementing its spectrum release proposals as referred to in the draft Decision. Interested parties will be invited to comment on that draft Information Memorandum when it is published.
- 10.10 Following receipt and consideration of submissions received in response to this document, the above draft Information Memorandum, and other relevant material, ComReg intends to publish a response to consultation and final Decision.
- 10.11 ComReg will have due regard to all comments received before publishing its final Information Memorandum. ComReg notes that any material changes made in the final RIAs and final decision may require subsequent changes to be made to the draft Information Memorandum and ComReg reserves the right to do so, if required.
- 10.12 ComReg cannot provide certainty on the timing of its subsequent publication, as it will be influenced by among other things the substance and volume of submissions received, however it will endeavour to publish its substantive Decision and Information Memorandum in 2020.

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Annex: 1 Glossary

A1.1 Definitions

- A 1.1 The definitions in this glossary shall apply to this document as a whole.
- A 1.2 Terms defined in this consultation paper shall, unless the context otherwise requires or admits, have the meaning set out below.
- A 1.3 Where a term in this glossary is defined by reference to a definition in a section or paragraph elsewhere in this document and an explanation of that term is provided in this glossary, the latter explanation is for convenience only and regard should be had to the appropriate part of the document for the definitive meaning of that term in its appropriate context.
- A 1.4 Any reference to any provision of any legislation shall include any modification re-enactment or extension thereof.

3.6 GHz Band	The frequency range 3400 - 3800 MHz
2.6 GHz EC Decision	Refers to EC Decision 2008/477/EC. See section A1.3 below for further details
700 MHz Band	The frequency range 694 – 790 MHz
700 MHz Duplex	The frequency range 703 - 733 MHz paired with 758 - 788 MHz
700 MHz Duplex Gap	The frequency range 733 - 758 MHz
700 MHz Guard Bands	Comprises of the following frequency ranges <ul style="list-style-type: none"> • 700 MHz Lower Guard Band (694 - 703 MHz); and • 700 MHz Upper Guard Band (788 - 791 MHz)
800 MHz Band	The frequency range 790 – 862 MHz
900 MHz Band	The frequency range 880 – 915 MHz paired with 925 – 960 MHz

1.4 GHz Band	The frequency range 1427 – 1517 MHz
1.4 GHz Centre Band	The frequency range 1452 – 1492 MHz
1.4 GHz Extension Bands	The frequency ranges 1427 – 1452 MHz and 1492 – 1517 MHz
1800 MHz Band	The frequency range 1710 – 1785 MHz paired with 1805 – 1880 MHz
Unpaired 2.1 GHz Band	The frequency range 1900 – 1920 MHz
2.1 GHz Band	The frequency ranges 1920 – 1980 MHz paired with 2110 – 2170 MHz
2.3 GHz Band	The frequency range 2300 – 2400 MHz
2.6 GHz Band	The frequency range 2500 – 2690 MHz
2.6 GHz Duplex	The frequency range 2500 – 2570 MHz paired with 2620 – 2 690 MHz
2.6 GHz Duplex Gap	The frequency range 2570 – 2620 MHz
26 GHz Band	The frequency range 24.25 – 27.5 GHz
Proposed Bands	ComReg proposes to include the 700 MHz Duplex, the 2.1 GHz Band, the 2.3 GHz Band and the 2.6 GHz Band in the Proposed Award
Capacity band	A spectrum band whose propagation characteristics, when used for mobile and similar services where user equipment is fitted with low gain antennas, render it unsuitable for its use to serve wide

	geographical areas, and may be more suitable for urban deployment as hot spots or high capacity infill
complementarity	The term can be taken as referring to spectrum bands where the value attributed by an interested party to spectrum in one band is enhanced by having or winning rights of use of spectrum in another band in relation to the Proposed Award
Coverage band	A spectrum band whose propagation characteristics when used with low gain antennas, render it suitable to serve wide geographical areas, such as the deployment of macro cells for wide area services.
General Authorisation ³²⁵	An authorisation for an undertaking to provide an electronic communications network or service under and in accordance with Regulation 4 of the Authorisation Regulations
2012 MBSA	2012 MBSA or the MBSA Process refers to the Multi-Band Spectrum Award process the final results of which were announced in ComReg Document 12/131 on 5 December 2012
3.6 GHz Award	Refers to the award process the final results of which were announced in ComReg Document 17/46 on 1 June 2017
NGA	Next Generation Access
NRA	National Regulatory Authority
RIA	Regulatory Impact Assessment, an analysis of the likely effect of, and necessity of, a proposed new regulation or regulatory change. Such assessments are carried out in accordance with ComReg Document 07/56a - Guidelines on ComReg's approach to Regulatory Impact Assessment - August 2007
Proposed Award	The proposed award of Spectrum right of use in the 700 MHz Duplex, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands

³²⁵ <https://www.comreg.ie/industry/licensing/general-authorisation/>

Proposed Bands	The 700 MHz Duplex, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands
Spectrum right of use	Authorisation to use certain radio frequencies subject to such conditions and restrictions as may be prescribed in a licence granted under section 5 of the Wireless Telegraphy Act of 1926 or by any Regulations made by ComReg under section 6 of the Wireless Telegraphy Act of 1926
substitutability	The term can be taken as referring to spectrum bands which can serve the same purpose for interested parties and so those parties are relatively indifferent to switching between those bands in relation to the Proposed Award
WBB	Wireless broadband

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A1.2 European and Governmental Bodies, Regulatory and Standardisation Organisations

3GPP	The 3 rd Generation Partnership Project
ComReg	Commission for Communications Regulation
CEPT	Conférence européenne des Administration des postes et des télécommunications. In English, European Conference of Postal and Telecommunications Administrations
DCCAE	Department of Communications, Climate Action and Environment
EC	European Commission
ECC	Electronic Communications Committee (of CEPT)
ECO	European Communications Office
EU	European Union
ITU	International Telecommunication Union
RSPG	Radio Spectrum Policy Group

A1.3 Primary and Secondary Legislation

S.I.	Statutory Instrument
2002 Act	The Communications Regulation Act 2002 (No. 20 of 2002), as amended
Authorisation Regulations	European Communities (Electronic Communication Networks and Services) (Authorisation) Regulations 2011 (S.I. No 335 of 2011)
Directive 2002/77/EC	A European Commission Directive on competition in the markets for electronic communications networks and services
EU Decision (EU)2017/899 / EP&C Decision 2017	Decision (EU) 2017/899 of the European Parliament and of the Council of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union
2.6 GHz EC Decision / EC Decision 2008/477/EC	European Commission Decision on the harmonisation of the 2500 - 2690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community
2.1 GHz EC Decision / EC Decision 2012/688/EU	European Commission Decision on the harmonisation of the frequency bands 1920 – 1980 MHz and 2110 – 2170 MHz for terrestrial systems capable of providing electronic communications services in the Community
700 MHz EC Decision / EC Decision 2016/687/EU	European Commission Decision on the harmonisation of the 694 - 790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union
EC Decision 2009/766/EC	European Commission Decision on the harmonisation of the 900 MHz and 1800 MHz

	frequency band for terrestrial systems capable of providing pan-European electronic communications services in the Community
EC Decision 2011/251/EU	European Commission Decision, amending Decision 2009/766/EC, on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community
3.6 GHz EC Decision / EC Decision 2014/276/EU	European Commission Decision on amending Decision 2008/411/EC on the harmonisation of the 3400 – 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community
RSPP Decision / European Parliament and Council Decision 243/2012/EU	European Parliament and Council Decision establishing a multi-annual radio spectrum policy programme
ECC Decision (13)03	Electronic Communications Committee decision to harmonise the use of the frequency band 1 452-1 492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)
2.3 GHz ECC Decision / ECC Decision ECC/DEC(14)02	Electronic Communications Committee decision to harmonised technical and regulatory conditions for the use of the band 2 300 - 2 400 MHz for Mobile/Fixed Communications Networks (MFCN)
Framework Regulations	European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. No 333 of 2011)
Specific Regulations	Specific Regulations has the same meaning as set out in Regulation 2 of the Framework Regulations

A1.4 Glossary of Technical Terms

3G	Third Generation Mobile System (e.g. UMTS)
BEM	A Block-Edge Mask (BEM) <i>“is an emission mask that is defined, as a function of frequency, relative to the edge of a block of spectrum for which rights of use are granted to an operator. It consists of in-block and out-of-block components which specify the permitted emission levels over frequencies inside and outside the licensed block of spectrum, respectively.”</i> (Source Annex to Decision 2012/688/EU)
CPI	Consumer Price Index
DTT	Digital Terrestrial Television
ECN	Electronic Communications Network (as defined under the Framework Regulations)
ECS	Electronic Communications Service (as defined under the Framework Regulations)
FDD	Frequency Division Duplex
FWA	Fixed Wireless Access
FWALA	Fixed Wireless Access Local Area
GHz	Gigahertz (1 000 000 000 Hertz)
Guard-band	An unused spectrum bandwidth separating channels to prevent interference
GSA	The Global mobile Suppliers Association - an organisation which represents suppliers of equipment and services to the mobile industry
GSM	Global System for Mobile Communications

GSMA	GSM Association – an organisation which represents mobile operators
Hertz	Unit of Frequency
kHz	Kilohertz (1 000 Hertz)
LTE	Long Term Evolution of 3G
LTE Advanced / LTE+	An evolution of LTE having the capability to provide 4G services
MFCN	Mobile/fixed communications networks
MHz	Megahertz (1 000 000 Hertz)
MNO	Mobile Network Operator
MVNO	Mobile Virtual Network Operator (a mobile operator with no spectrum assignment and with or without network infrastructure)
BB-PPDR	<p>Broadband (BB)</p> <p>Public Protection (PP) radio communication: Radio communications used by responsible agencies and organisations dealing with maintenance of law and order, protection of life and property, and emergency situations</p> <p>Disaster Relief (DR) radio communication: Radio communications used by agencies and organisations dealing with a serious disruption of the functioning of society, posing a significant, widespread threat to human life, health, property or the environment, whether caused by accident, nature or human activity, and whether developing suddenly or as a result of complex, long-term processes</p>
RSRP	Reference signal receive power

SDL	Supplementary Downlink
TDD	Time Division Duplex
TD-LTE	Time Division – Long Term Evolution
TRP	Total Radiated Power
UMTS	Universal Mobile Telecommunications System.
WDMDS	Wideband Digital Mobile Data Services
WRC	World Radiocommunications Conference

A1.5 Glossary of respondents³²⁶

Dense Air	Dense Air Ireland Limited
Eircom	Eircom Limited
Ericsson	Ericsson Ireland / Ericsson AB
Imagine	Imagine Communications Ireland Limited
Mr. Liam Young	-
Motorola	Motorola Solutions
MVNO Europe	-
Three	Three Ireland Hutchison Limited
Virgin Media	Virgin Media Ireland Limited

³²⁶ This list provides the reference used in this document and further details for the entity(s) where known. Not all respondents provided full details of its company name in its response. ComReg has aimed to update the table based on the information available to it, but would welcome clarifications on same.

Vodafone	Vodafone Ireland Limited
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Annex: 2 Legal Framework and Statutory Objectives

- A 2.1 The Communications Regulation Act 2002 (as amended by the Communications Regulation (Amendment) Act 2007) (the “2002 Act”), the EU Common Regulatory Framework (including the Framework and Authorisation Directives³²⁷ as transposed into Irish law by the corresponding Framework and Authorisation Regulations³²⁸), and the Wireless Telegraphy Acts 1926 to 2009³²⁹ set out, amongst other things, powers, functions, duties and objectives of ComReg that are relevant to the management of the radio frequency spectrum in Ireland and to this consultation document.
- A 2.2 Apart from licensing and making regulations in relation to licences, ComReg’s functions include the management of Ireland’s radio frequency spectrum in accordance with ministerial Policy Directions under section 13 of the 2002 Act, having regard to its objectives under section 12 of the 2002 Act, Regulation 16 of the Framework Regulations and the provisions of Article 8a of the Framework Directive. ComReg is to carry out its functions effectively, and in a manner serving to ensure that the allocation and assignment of radio frequencies is based on objective, transparent, non-discriminatory and proportionate criteria.
- A 2.3 This annex is intended as a general guide as to ComReg’s role in this area, and not as a definitive or exhaustive legal exposition of that role. Further, this annex restricts itself to consideration of those powers, functions, duties and objectives of ComReg that appear most relevant to the matters at hand and generally excludes those not considered relevant (for example, in relation to postal services, premium rate services or market analysis). For the avoidance of doubt, however, the inclusion of particular material in this annex does not necessarily mean that ComReg considers same to be of

³²⁷ Directive No. 2002/21/EC of the European Parliament and of the Council of 7 March 2002 (as amended by Regulation (EC) No. 717/2007 of 27 June 2007, Regulation (EC) No. 544/2009 of 18 June 2009 and Directive 2009/140/EC of the European Parliament and Council of 25 November 2009) (the “Framework Directive”) and Directive No. 2002/20/EC of the European Parliament and of the Council of 7 March 2002 (as amended by Directive 2009/140/EC) (the “Authorisation Directive”).

³²⁸ The European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. No. 333 of 2011) and the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011 (S.I. No. 335 of 2011) respectively.

³²⁹ The Wireless Telegraphy Acts 1926 to 1988 and Sections 181 (1) to (7) and (9) and Section 182 of the Broadcasting Act 2009.

specific relevance to the matters at hand.

A 2.4 All references in this annex to enactments are to the enactment as amended at the date hereof, unless the context otherwise requires.

New European Electronic Communications Code

A 2.5 On 20 December 2018, Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (“EECC”) entered into force.

A 2.6 The EECC replaces the EU Common Regulatory Framework adopted in 2002 (and amended in 2009) under which ComReg has regulated electronic communications since 2003.

A 2.7 With some limited exceptions (see Article 124 of the EECC), Member States have until 21 December 2020 to transpose the EECC into national law.³³⁰ Until then, the existing EU Common Regulatory Framework will continue to apply. However, in developing its proposals for the Proposed Award, ComReg is mindful of the EECC.

A 2.8 ComReg understands that the DCCA will be responsible for the transposition of the EECC and will assist as appropriate.

A2.1 Primary Objectives and Regulatory Principles under the 2002 Act and Common Regulatory Framework

A 2.9 ComReg’s primary objectives in carrying out its statutory functions in the context of electronic communications are to:

- promote competition³³¹;
- contribute to the development of the internal market³³²;
- promote the interests of users within the Community³³³;

³³⁰ With the exception of Articles 53(2), (3) and (4), and Article 54 (see Article 124).

³³¹ Section 12 (1)(a)(i) of the 2002 Act.

³³² Section 12 (1)(a)(ii) of the 2002 Act.

³³³ Section 12(1)(a)(iii) of the 2002 Act.

- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under section 13 of the 2002 Act³³⁴; and
- unless otherwise provided for in Regulation 17 of the Framework Regulations, take the utmost account of the desirability of technological neutrality in complying with the requirements of the Specific Regulations³³⁵ in particular those designed to ensure effective competition³³⁶.

A2.1.1 Promotion of Competition

A 2.10 Section 12(2)(a) of the 2002 Act requires ComReg to take all reasonable measures which are aimed at the promotion of competition, including:

- ensuring that users, including disabled users, derive maximum benefit in terms of choice, price and quality;
- ensuring that there is no distortion or restriction of competition in the electronic communications sector; and
- encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources.

A 2.11 In so far as the promotion of competition is concerned, Regulation 16(1)(b) of the Framework Regulations also requires ComReg to:

- ensure that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality, and
- ensure that, in the transmission of content, there is no distortion or restriction of competition in the electronic communications sector.

A 2.12 Regulation 9(11) of the Authorisation Regulations also provides that

³³⁴ Section 12(1)(b) of the 2002 Act. Whilst this objective would appear to be a separate and distinct objective in the 2002 Act, it is noted that, for the purposes of ComReg's activities in relation to electronic communications networks and services ("ECN" and "ECS"), Article 8 of the Framework Directive identifies "*encouraging efficient use and ensuring the effective management of radio frequencies (and numbering resources)*" as a sub-objective of the broader objective of the promotion of competition.

³³⁵ The 'Specific Regulations' comprise collectively the Framework Regulations, the Authorisation Regulations, the European Communities (Electronic Communications Networks and Services) (Access) Regulations 2011 (S.I. No. 334 of 2011), the European Communities (Electronic Communications Networks and Services) (Universal Service and Users' Rights) Regulations 2011 (S.I. 337 of 2011) and the European Communities (Electronic Communications Networks and Services) (Privacy and Electronic Communications) Regulations 2011 (S.I. No. 336 of 2011).

³³⁶ Regulation 16(1)(a) of the Framework Regulations.

ComReg must ensure that radio frequencies are efficiently and effectively used having regard to section 12(2)(a) of the 2002 Act and Regulations 16(1) and 17(1) of the Framework Regulations. Regulation 9(11) further provides that ComReg must ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies and, for this purpose, ComReg may take appropriate measures such as mandating the sale or the lease of rights of use for radio frequencies.

A2.1.2 Contributing to the Development of the Internal Market

A 2.13 Section 12(2)(b) of the 2002 Act requires ComReg to take all reasonable measures which are aimed at contributing to the development of the internal market, including:

- removing remaining obstacles to the provision of ECN, ECS and associated facilities at Community level;
- encouraging the establishment and development of trans-European networks and the interoperability of transnational services and end-to-end connectivity; and
- co-operating with electronic communications national regulatory authorities in other Member States of the Community and with the Commission of the Community in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of Community law in this field.

A 2.14 In so far as contributing to the development of the internal market is concerned, Regulation 16(1)(c) of the Framework Regulations also requires ComReg to co-operate with the Body of European Regulators for Electronic Communications (“BEREC”) in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of EU law in the field of electronic communications.

A2.1.3 Promotion of Interests of Users

A 2.15 Section 12(2)(c) of the 2002 Act requires ComReg, when exercising its functions in relation to the provision of electronic communications networks and services, to take all reasonable measures which are aimed at the promotion of the interests of users within the Community, including:

- ensuring that all users have access to a universal service;
- ensuring a high level of protection for consumers in their dealings with suppliers, in particular by ensuring the availability of simple and

inexpensive dispute resolution procedures carried out by a body that is independent of the parties involved;

- contributing to ensuring a high level of protection of personal data and privacy;
- promoting the provision of clear information, in particular requiring transparency of tariffs and conditions for using publicly available ECS;
- encouraging access to the internet at reasonable cost to users;
- addressing the needs of specific social groups, in particular disabled users; and
- ensuring that the integrity and security of public communications networks are maintained.

A 2.16 In so far as promotion of the interests of users within the EU is concerned, Regulation 16(1)(d) of the Framework Regulations also requires ComReg to:

- address the needs of specific social groups, in particular, elderly users and users with special social needs, and
- promote the ability of end-users to access and distribute information or use applications and services of their choice.

A2.1.4 Regulatory Principles

A 2.17 In pursuit of its objectives under Regulation 16(1) of the Framework Regulations and section 12 of the 2002 Act, ComReg must apply objective, transparent, non-discriminatory and proportionate regulatory principles by, amongst other things:

- promoting regulatory predictability by ensuring a consistent regulatory approach over appropriate review periods;
- ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing ECN and ECS;
- safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure-based competition;
- promoting efficient investment and innovation in new and enhanced infrastructures, including by ensuring that any access obligation takes appropriate account of the risk incurred by the investing undertakings

and by permitting various cooperative arrangements between investors and parties seeking access to diversify the risk of investment, while ensuring that competition in the market and the principle of non-discrimination are preserved;

- taking due account of the variety of conditions relating to competition and consumers that exist in the various geographic areas within the State; and
- imposing ex-ante regulatory obligations only where there is no effective and sustainable competition and relaxing or lifting such obligations as soon as that condition is fulfilled.

A2.1.5 BEREC

A 2.18 Under Regulation 16(1)(3) of the Framework Regulations, ComReg must:

- having regard to its objectives under section 12 of the 2002 Act and its functions under the Specific Regulations, actively support the goals of BEREC of promoting greater regulatory co-ordination and coherence; and
- take the utmost account of opinions and common positions adopted by BEREC when adopting decisions for the national market.

A2.1.6 Other Obligations under the 2002 Act

A 2.19 In carrying out its functions, ComReg is required, amongst other things, to:

- seek to ensure that any measures taken by it are proportionate having regard to the objectives set out in section 12 of the 2002 Act;³³⁷
- have regard to international developments with regard to the radio frequency spectrum³³⁸; and
- take the utmost account of the desirability that the exercise of its functions aimed at achieving its radio frequency management objectives does not result in discrimination in favour of or against particular types of technology for the provision of ECS.³³⁹

³³⁷ Section 12(3) of the 2002 Act.

³³⁸ Section 12(5) of the 2002 Act.

³³⁹ Section 12(6) of the 2002 Act.

A2.1.7 Policy Directions³⁴⁰

A 2.20 Section 12(4) of the 2002 Act provides that, in carrying out its functions, ComReg must have appropriate regard to policy statements, published by or on behalf of the Government or a Minister of the Government and notified to the Commission, in relation to the economic and social development of the State. Section 13(1) of the 2002 Act requires ComReg to comply with any policy direction given to ComReg by the Minister for Communications, Energy and Natural Resources (“the Minister”) as he or she considers appropriate, in the interests of the proper and effective regulation of the electronic communications market, the management of the radio frequency spectrum in the State and the formulation of policy applicable to such proper and effective regulation and management, to be followed by ComReg in the exercise of its functions. Section 10(1)(b) of the 2002 Act also requires ComReg, in managing the radio frequency spectrum, to do so in accordance with a direction of the Minister under section 13 of the 2002 Act, while Section 12(1)(b) requires ComReg to ensure the efficient management and use of the radio frequency spectrum in accordance with a direction under Section 13.

A 2.21 The Policy Directions which are most relevant in this regard include the following:

Policy Direction No.3 on Broadband Electronic Communication Networks

A 2.22 ComReg shall in the exercise of its functions, take into account the national objective regarding broadband rollout, viz, the Government wishes to ensure the widespread availability of open-access, affordable, always-on broadband infrastructure and services for businesses and citizens on a balanced regional basis within three years, on the basis of utilisation of a range of existing and emerging technologies and broadband speeds appropriate to specific categories of service and customers.

Policy Direction No.4 on Industry Sustainability

A 2.23 ComReg shall ensure that in making regulatory decisions in relation to the electronic communications market, it takes account of the state of the industry and in particular the industry’s position in the business cycle and the impact of such decisions on the sustainability of the business of undertakings affected.

³⁴⁰ ComReg also notes, and takes due account of, the Spectrum Policy Statement issued by the Department of Communications Energy and Natural Resources in September 2010.

Policy Direction No.5 on Regulation only where necessary

A 2.24 Where ComReg has discretion as to whether to impose regulatory obligations, it shall, before deciding to impose such regulatory obligations on undertakings, examine whether the objectives of such regulatory obligations would be better achieved by forbearance from imposition of such obligations and reliance instead on market forces.

Policy Direction No.6 on Regulatory Impact Assessment

A 2.25 ComReg, before deciding to impose regulatory obligations on undertakings in the market for electronic communications or for the purposes of the management and use of the radio frequency spectrum or for the purposes of the regulation of the postal sector, shall conduct a Regulatory Impact Assessment in accordance with European and International best practice and otherwise in accordance with measures that may be adopted under the Government's Better Regulation programme.

Policy Direction No.7 on Consistency with other Member States

A 2.26 ComReg shall ensure that, where market circumstances are equivalent, the regulatory obligations imposed on undertakings in the electronic communications market in Ireland should be equivalent to those imposed on undertakings in equivalent positions in other Member States of the European Community.

Policy Direction No.11 on the Management of the Radio Frequency Spectrum

A 2.27 ComReg shall ensure that, in its management of the radio frequency spectrum, it takes account of the interests of all users of the radio frequency spectrum.

General Policy Direction No.1 on Competition (2004)

A 2.28 ComReg shall focus on the promotion of competition as a key objective. Where necessary, ComReg shall implement remedies which counteract or remove barriers to market entry and shall support entry by new players to the market and entry into new sectors by existing players. ComReg shall have a particular focus on:

- market share of new entrants;
- ensuring that the applicable margin attributable to a product at the wholesale level is sufficient to promote and sustain competition;
- price level to the end user;

- competition in the fixed and mobile markets; and
- the potential of alternative technology delivery platforms to support competition

A2.2 Other Relevant Obligations under the Framework and Authorisation Regulations

A2.2.1 Framework Regulations

Regulation 17

A 2.29 Regulation 17 of the Framework Regulations governs the management of radio frequencies for ECS. Regulation 17(1) requires that ComReg, subject to any directions issued by the Minister pursuant to Section 13 of the 2002 Act and having regard to its objectives under Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations and the provisions of Article 8a of the Framework Directive, ensure:

- the effective management of radio frequencies for ECS;
- that spectrum allocation used for ECS and issuing of general authorisations or individual rights of use for such radio frequencies are based on objective, transparent, non-discriminatory and proportionate criteria; and
- ensure that harmonisation of the use of radio frequency spectrum across the EU is promoted, consistent with the need to ensure its effective and efficient use and in pursuit of benefits for the consumer such as economies of scale and interoperability of services, having regard to all decisions and measures adopted by the European Commission in accordance with Decision No. 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the EU.

A 2.30 Regulation 17(2) provides that, unless otherwise provided in Regulation 17(3), ComReg must ensure that all types of technology used for ECS may be used in the radio frequency bands that are declared available for ECS in the Radio Frequency Plan published under Section 35 of the 2002 Act in accordance with EU law.

A 2.31 Regulation 17(3) provides that, notwithstanding Regulation 17(2), ComReg may, through licence conditions or otherwise, provide for proportionate and non-discriminatory restrictions to the types of radio network or wireless access technology used for ECS where this is necessary to:

- avoid harmful interference;
- protect public health against electromagnetic fields;
- ensure technical quality of service;
- ensure maximisation of radio frequency sharing;
- safeguard the efficient use of spectrum; or
- ensure the fulfilment of a general interest objective as defined by or on behalf of the Government or a Minister of the Government in accordance with Regulation 17(6).

A 2.32 Regulation 17(4) requires that, unless otherwise provided in Regulation 17(5), ComReg must ensure that all types of ECS may be provided in the radio frequency bands, declared available for ECS in the Radio Frequency Plan published under Section 35 of the Act of 2002 in accordance with EU law.

A 2.33 Regulation 17(5) provides that, notwithstanding Regulation 17(4), ComReg may provide for proportionate and non-discriminatory restrictions to the types of ECS to be provided, including where necessary, to fulfil a requirement under the International Telecommunication Union Radio Regulations ("ITU-RR").

A 2.34 Regulation 17(6) requires that measures that require an ECS to be provided in a specific band available for ECS must be justified in order to ensure the fulfilment of a general interest objective as defined by or on behalf of the Government or a Minister of the Government in conformity with EU law such as, but not limited to:

- safety of life;
- the promotion of social, regional or territorial cohesion;
- the avoidance of inefficient use of radio frequencies; or
- the promotion of cultural and linguistic diversity and media pluralism, for example, by the provision of radio and television broadcasting services.

A 2.35 Regulation 17(7) provides that ComReg may only prohibit the provision of any other ECS in a specific radio spectrum frequency band where such a prohibition is justified by the need to protect safety of life services. ComReg may, on an exceptional basis, extend such a measure in order to fulfil other

general interest objectives as defined by or on behalf of the Government or a Minister of the Government.

- A 2.36 Regulation 17(8) provides that ComReg must, in accordance with Regulation 18, regularly review the necessity of the restrictions referred to in Regulations 17(3) and 17(5) and must make the results of such reviews publicly available.
- A 2.37 Regulation 17(9) provides that Regulations 17(2) to (7) only apply to spectrum allocated to be used for ECS, general authorisations issued and individual rights of use for radio frequencies granted after 1 July 2011. Spectrum allocations, general authorisations and individual rights of use which already existed on 1 July 2011 are subject to Regulation 18 of the Framework Regulations.
- A 2.38 Regulation 17(10) provides that ComReg may, having regard to its objectives under Section 12 of the 2002 Act and Regulation 16 and its functions under the Specific Regulations, lay down rules in order to prevent spectrum hoarding, in particular by setting out strict deadlines for the effective exploitation of the rights of use by the holder of rights and by withdrawing the rights of use in cases of non-compliance with the deadlines. Any rules laid down under this Regulation must be applied in a proportionate, non-discriminatory and transparent manner.
- A 2.39 Regulation 17(11) requires ComReg to, in the fulfilment of its obligations under that Regulation, respect relevant international agreements, including the ITU-RR and any public policy considerations brought to its attention by the Minister.

Regulation 23 on security and integrity and Regulation 24 on implementation and enforcement of Regulation 23

- A 2.40 Regulation 23 provides:

23. (1) Undertakings providing public communications networks or publicly available electronic communications services shall take appropriate technical and organisational measures to appropriately manage the risks posed to security of networks and services. In particular, measures shall be taken to prevent and minimise the impact of security incidents on users and interconnected networks.

(2) The technical and organisational measures referred to in paragraph (1) shall, having regard to the state of the art, ensure a level of security appropriate to the risk presented.

(3) Undertakings providing public communications networks shall take all appropriate steps to guarantee the integrity of their networks, thereby ensuring the continuity of supply of services provided over those networks.

(4) (a) An undertaking providing public communications networks or publicly available electronic communications services shall notify the Regulator in the event of a breach of security or loss of integrity that has a significant impact on the operation of networks or services.

(b) Where the Regulator receives a notification under subparagraph (a), it shall inform the Minister of the said notification and, with the agreement of the Minister, it shall also, where appropriate, inform the national regulatory authorities in other Member States and ENISA.

(c) Where it is considered that it is in the public interest to do so the Regulator, with the agreement of the Minister, may inform the public in relation to the breach notified under subparagraph (a) or require the undertaking to inform the public accordingly.

(5) The Regulator shall annually submit a summary report to the Minister, the European Commission and EINSAs on the notifications received and the actions taken in accordance with paragraph (4).

(6) An undertaking that fails to comply with the requirements of paragraph (4)(a) or (c) commits an offence.

A 2.41 Regulation 24 provides:

24. (1) For the purpose of ensuring compliance with Regulation 23 (1), (2) and (3), the Regulator may issue directions to an undertaking providing public communications networks or publicly available electronic communications services, including directions in relation to time limits for implementation.

(2) The Regulator may require an undertaking providing public communications networks or publicly available electronic communications services to—

(a) provide information needed to assess the security or integrity of their services and networks, including documented security policies, and

(b) submit to a security audit to be carried out by a qualified independent body nominated by the Regulator and make the results of the audit available to the Regulator and the Minister. The cost of the audit is to be borne by the undertaking.

(3) An undertaking in receipt of a direction under paragraph (1) shall comply with the direction.

(4) An undertaking that fails to comply with a direction under paragraph (1) or a requirement under paragraph (2) commits an offence.

A2.2.2 Authorisation Regulations

Decision to limit rights of use for radio frequencies

A 2.42 Regulation 9(2) of the Authorisation Regulations provides that ComReg may grant individual rights of use for radio frequencies by way of a licence where it considers that one or more of the following criteria are applicable:

- it is necessary to avoid harmful interference;
- it is necessary to ensure technical quality of service;
- it is necessary to safeguard the efficient use of spectrum; or
- it is necessary to fulfil other objectives of general interest as defined by or on behalf of the Government or a Minister of the Government in conformity with EU law.

A 2.43 Regulation 9(10) of the Authorisation Regulations provides that ComReg must not limit the number of rights of use for radio frequencies to be granted except where this is necessary to ensure the efficient use of radio frequencies in accordance with Regulation 11.

A 2.44 Regulation 9(7) also provides that:

- where individual rights of use for radio frequencies are granted for a period of 10 years or more and such rights may not be transferred or leased between undertakings in accordance with Regulation 19 of the Framework Regulations, ComReg must ensure that criteria set out in Regulation 9(2) apply for the duration of the rights of use, in particular upon a justified request from the holder of the right.
- where ComReg determines that the criteria referred to in Regulation 9(2) are no longer applicable to a right of use for radio frequencies, ComReg must, after a reasonable period and having notified the holder of the individual rights of use, change the individual rights of use into a general authorisation or must ensure that the individual rights of use are made transferable or leasable between undertakings in accordance with Regulation 19 of the Framework Regulations.

Publication of procedures

A 2.45 Regulation 9(4)(a) of the Authorisation Regulations requires that ComReg, having regard to the provisions of Regulation 17 of the Framework Regulations, establish open, objective, transparent, non-discriminatory and proportionate procedures for the granting of rights of use for radio frequencies and cause any such procedures to be made publicly available.

Duration of rights of use for radio frequencies

A 2.46 Regulation 9(6) of the Authorisation Regulations provides that rights of use for radio frequencies must be in force for such period as ComReg considers appropriate having regard to the network or service concerned in view of the objective pursued taking due account of the need to allow for an appropriate period for investment amortisation.

Conditions attached to rights of use for radio frequencies

A 2.47 Regulation 9(5) of the Authorisation Regulations provides that, when granting rights of use for radio frequencies, ComReg must, having regard to the provisions of Regulations 17 and 19 of the Framework Regulations, specify whether such rights may be transferred by the holder of the rights and under what conditions such a transfer may take place.

A 2.48 Regulation 10(1) of the Authorisation Regulations provides that, notwithstanding Section 5 of the Wireless Telegraphy Act, 1926, but subject to any regulations under Section 6 of that Act, ComReg may only attach those conditions listed in Part B of the Schedule to the Authorisation Regulations. Part B lists the following conditions which may be attached to rights of use:

- Obligation to provide a service or to use a type of technology for which the rights of use for the frequency has been granted including, where appropriate, coverage and quality requirements.
- Effective and efficient use of frequencies in conformity with the Framework Directive and Framework Regulations.
- Technical and operational conditions necessary for the avoidance of harmful interference and for the limitation of exposure of the general public to electromagnetic fields, where such conditions are different from those included in the general authorisation.
- Maximum duration in conformity with Regulation 9, subject to any changes in the national frequency plan.

- Transfer of rights at the initiative of the rights holder and conditions of such transfer in conformity with the Framework Directive.
- Usage fees in accordance with Regulation 19.
- Any commitments which the undertaking obtaining the usage right has made in the course of a competitive or comparative selection procedure.
- Obligations under relevant international agreements relating to the use of frequencies.
- Obligations specific to an experimental use of radio frequencies.

A 2.49 Regulation 10(2) also requires that any attachment of conditions under Regulation 10(1) to rights of use for radio frequencies must be non-discriminatory, proportionate and transparent and in accordance with Regulation 17 of the Framework Regulations.

Procedures for limiting the number of rights of use to be granted for radio frequencies

A 2.50 Regulation 11(1) of the Authorisation Regulations provides that, where ComReg considers that the number of rights of use to be granted for radio frequencies should be limited it must, without prejudice to Sections 13 and 37 of the 2002 Act:

- give due weight to the need to maximise benefits for users and to facilitate the development of competition, and
- give all interested parties, including users and consumers, the opportunity to express their views in accordance with Regulation 12 of the Framework Regulations.

A 2.51 Regulation 11(2) of the Authorisation Regulations requires that, when granting the limited number of rights of use for radio frequencies it has decided upon, ComReg does so “...on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to the achievement of the objectives set out in Section 12 of the 2002 Act and Regulations 16 and 17 of the Framework Regulations.”

A 2.52 Regulation 11(4) provides that where it decides to use competitive or comparative selection procedures, ComReg must, inter alia, ensure that such procedures are fair, reasonable, open and transparent to all interested parties.

Fees for spectrum rights of use

- A 2.53 Regulation 19 of the Authorisation Regulations permits ComReg to impose fees for rights of use which reflect the need to ensure the optimal use of the radio frequency spectrum.
- A 2.54 ComReg is required to ensure that any such fees are objectively justified, transparent, non-discriminatory and proportionate in relation to their intended purpose and take into account the objectives of ComReg as set out in Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations.

Amendment of rights and obligations

- A 2.55 Regulation 15 of the Authorisation Regulations permits ComReg to amend rights and conditions concerning rights of use, provided that any such amendments may only be made in objectively justified cases and in a proportionate manner, following the process set down in Regulation 15(4).

A2.3 Other Relevant Provisions

Wireless Telegraphy Act, 1926 (the “1926 Act”)

- A 2.56 Under Section 5(1) of the 1926 Act, ComReg may, subject to that Act, and on payment of the prescribed fees (if any), grant to any person a licence to keep and have possession of apparatus for wireless telegraphy in any specified place in the State.
- A 2.57 Section 5(2) provides that, such a licence shall be in such form, continue in force for such period and be subject to such conditions and restrictions (including conditions as to suspension and revocation) as may be prescribed in regard to it by regulations made by ComReg under Section 6.
- A 2.58 Section 5(3) also provides that, where it appears appropriate to ComReg, it may, in the interests of the efficient and orderly use of wireless telegraphy, limit the number of licences for any particular class or classes of apparatus for wireless telegraphy granted under Section 5.
- A 2.59 Section 6 provides that ComReg may make regulations prescribing in relation to all licences granted by it under Section 5, or any particular class or classes of such licences, all or any of the following matters:
- the form of such licences;
 - the period during which such licences continue in force;

- the manner in which, the terms on which, and the period or periods for which such licences may be renewed;
- the circumstances in which or the terms under which such licences are granted;
- the circumstances and manner in which such licences may be suspended or revoked by ComReg;
- the terms and conditions to be observed by the holders of such licences and subject to which such licences are deemed to be granted;
- the fees to be paid on the application, grant or renewal of such licences or classes of such licences, subject to such exceptions as ComReg may prescribe, and the time and manner at and in which such fees are to be paid; and
- matters which such licences do not entitle or authorise the holder to do.

A 2.60 Section 6(2) provides that Regulations made by ComReg under Regulation 6 may authorise and provide for the granting of a licence under Section 5 subject to special terms, conditions, and restrictions to persons who satisfy it that they require the licences solely for the purpose of conducting experiments in wireless telegraphy.

A 2.61 Regulation 10(1) of the Authorisation Regulations provides that, notwithstanding section 5 of the Act of 1926 but subject to any regulations made under section 6 of that Act, where ComReg attaches conditions to rights of use for radio frequencies, it may only attach such conditions as are listed in Part B of the Schedule to the Authorisation Regulations.

Broadcasting Act 2009 (the “2009 Act”)

A 2.62 Section 132 of the 2009 Act relates to the duties of ComReg in respect of the licensing of spectrum for use in establishing digital terrestrial television multiplexes and places an obligation on ComReg to issue:

- two DTT multiplex licences to RTÉ by request (see Sections 132(1) and (2) of the 2009 Act); and
- a minimum of four DTT multiplex licences to the BAI by request (see Sections 132(3) and (4) of the 2009 Act) for the provision of commercial TV content.

Article 4 of Directive 2002/77/EC (Competition Directive)

A 2.63 Article 4 of the Competition Directive provides that:

“Without prejudice to specific criteria and procedures adopted by Member States to grant rights of use of radio frequencies to providers of radio or television broadcast content services with a view to pursuing general interest objectives in conformity with Community law:

- *Member States shall not grant exclusive or special rights of use of radio frequencies for the provision of electronic communications services.*
- *The assignment of radio frequencies for electronic communication services shall be based on objective, transparent, non-discriminatory and proportionate criteria.”*

Radio Spectrum Policy Programme

A 2.64 On 15 February 2012, the European Parliament adopted the five-year Radio Spectrum Policy Programme (“RSPP”) which establishes a multi-annual radio spectrum policy programme for the strategic planning and harmonisation of the use of spectrum. The objective is to ensure the functioning of the internal market in the Union policy areas involving the use of spectrum, such as electronic communications, research, technological development and space, transport, energy and audiovisual policies.

A 2.65 Among other things, Article 5 of the RSPP, entitled “Competition”, provides:

“1. Member States shall promote effective competition and shall avoid distortions of competition in the internal market for electronic communications services in accordance with Directives 2002/20/EC and 2002/21/EC.

They shall also take into account competition issues when granting rights of use of spectrum to users of private electronic communication networks.

2. For the purposes of the first subparagraph of paragraph 1 and without prejudice to the application of competition rules and to the measures adopted by Member States in order to achieve general interest objectives in accordance with Article 9(4) of Directive 2002/21/EC, Member States may adopt, inter alia, measures:

(a) limiting the amount of spectrum for which rights of use are granted to any undertaking, or attaching conditions to such rights of use, such as the provision of wholesale access, national or regional roaming, in

certain bands or in certain groups of bands with similar characteristics, for instance the bands below 1 GHz allocated to electronic communication services. Such additional conditions may be imposed only by the competent national authority;

(b) reserving, if appropriate in regard to the situation in the national market, a certain part of a frequency band or group of bands for assignment to new entrants;

(c) refusing to grant new rights of use of spectrum or to allow new spectrum uses in certain bands, or attaching conditions to the grant of new rights of use of spectrum or to the authorisation of new spectrum uses, in order to avoid the distortion of competition by any assignment, transfer or accumulation of rights of use;

(d) prohibiting or imposing conditions on transfers of rights of use of spectrum, not subject to national or Union merger control, where such transfers are likely to result in significant harm to competition;

(e) amending the existing rights in accordance with Directive 2002/20/EC where this is necessary to remedy ex post the distortion of competition by any transfer or accumulation of rights of use of radio frequencies.

3. Where Member States wish to adopt any measures referred to in paragraph 2 of this Article, they shall act in conformity with the procedures for the imposition or variation of such conditions on the rights of use of spectrum laid down in Directive 2002/20/EC.

4. Member States shall ensure that the authorisation and selection procedures for electronic communications services promote effective competition for the benefit of citizens, consumers and businesses in the Union.”

Annex: 3 The Connectivity Studies

A 3.1 This annex:

- provides an overview of the Connectivity Studies commissioned by ComReg (see paragraph A3.4 below);
- summarises the views of respondents in relation to the Connectivity Studies;
- summarises Oxera and DotEcon's assessment of those responses; and
- sets out ComReg's views having carefully considered the above.

A3.1 Summary of Document 19/59R

A 3.2 As summarised in section 2 of Document 19/59R, to assist in the development of proposals for its forthcoming spectrum awards, and in particular its consideration of appropriate coverage obligations, ComReg commissioned three studies on different aspects of providing connectivity in Ireland, including estimated costings to extend mobile coverage to high levels.

A 3.3 In this context, "connectivity" is the ability of users and their devices to connect and communicate with each other and their networks. This can take different forms, with many different networks and devices being used, increasingly seamlessly, to communicate and consume content and applications.

A 3.4 In November 2018, ComReg published the results of these studies in the form of the following three reports:

- "*Meeting Consumers' Connectivity Needs*" – a report (Document [18/103b](#)) and accompanying infographic (Document [18/103a](#)) from Frontier Economics Ltd (Frontier) - which provides an overview of the challenges in providing connectivity for consumers in Ireland and outlines actions that can be taken by all stakeholders, including consumers, industry, government and ComReg, to optimise the levels of connectivity given these challenges (Frontier Connectivity Report);
- "*Future Mobile Connectivity in Ireland*" - a report (Document [18/103c](#)) from Oxera Consulting LLP (Oxera), with Real Wireless Ltd - which considers the future mobile connectivity services likely to emerge in

Ireland and the estimated costs of providing connectivity to such services at high coverage levels in Ireland (Oxera Connectivity Report);

- “Coverage obligations and spectrum awards” – a report (Document [18/103d](#)) from DotEcon - which considers options as to how appropriate coverage and rollout obligations could be included in future spectrum awards (DotEcon Connectivity Report),
- (together the “Connectivity Studies”).

A 3.5 In addition, ComReg summarised the key messages and recommendations in these studies, as published in ComReg’s Information Notice³⁴¹.

A 3.6 ComReg also stated that the Connectivity Studies assist it in the development of proposals for the proposed award, and in particular its consideration of appropriate coverage obligations. It encouraged interested parties to consider this information.

A3.2 Summary of respondents views to the Oxera connectivity report (Document 18/103c)

A 3.7 Two respondents (Mr. Young and Vodafone) provided comments on the Oxera Connectivity Report.

A 3.8 Vodafone acknowledged the comprehensive work set out in Connectivity Studies and is of the view that this provides a considered quantification of the additional investment needed to increase coverage to higher levels in Ireland.

A 3.9 However, Vodafone also cautions that the Connectivity Studies overstate the development of coverage that will occur without intervention for the following reasons:

- *“A significant portion of operator budget has been taken with the roll-out of replacement sites - for example in Dublin up to 30 sites a year are lost as buildings are re-developed forcing operators to build alternative sites just to maintain coverage;*
- *Due to the use of multiple frequency bands requiring many antennae, and the extensive implementation of tower sharing among operators, much of the tower infrastructure available now required structural upgrade. This increases the cost of adding frequency bands on sites to much higher figure than assumed in*

³⁴¹ Document [18/103](#) - “Improving connectivity in Ireland – Challenges, solutions and actions.”

Oxera calculations. One specific example of Oxera underestimating cost is that they assume a labour cost of €500 for upgrades. Our experience is that the labour cost is more typically € 5,000 per site, including the planning work.

- *The count of new sites being built per year has reduced since the data set used by ComReg; and*
- *In a small number of areas sites have not been built because operators have failed to receive the required planning permission.”*

A 3.10 Mr. Young is also of the view that the Connectivity Studies provide useful analysis in weighing up the costs and implications of an interventionist approach to drive coverage and download speeds. However he believes that the reports may understate the coverage that will occur without intervention, as in his view the analysis is “*somewhat retrospective rather than forward looking*” towards the use of new technologies which are both 5G and non-5G related. For example:

- the Oxera Connectivity Report does not consider improved antenna, beam-forming, small cell and fixed wireless access solutions; and
- the international comparisons in the Oxera Connectivity Report do not include a consideration of 5G networks and demand.

A 3.11 Mr. Young also provided a number of specific comments on the Oxera Connectivity Report:

- The report is focused on interviews with Irish MNOs and equipment vendors and does not include an end-user demand survey. In his view it is the end-users that will ultimately determine how the market develops;
- While the report includes the use of the 700 MHz band and carrier aggregation technology, the model does not detail the extent to which these will be deployed by Irish MNOs. In his view, the use of the 700 MHz band and carrier aggregation technology brings significant coverage benefits and the model may not fully account for these positive effects; and
- He queried the model input assumption regarding the likelihood of lower macrosite antenna heights in rural areas compared to urban locations. Although possible, Mr Young suggests that this may be unlikely given Irish planning restrictions on urban building height, and the topographical features of rural Ireland, where hilltop macrosites are commonly located.

A3.3 Summary of Oxera's assessment

A 3.12 Oxera's consideration of respondents' views is set out in Document 19/124f and summarised below in terms of (i) modelling approach, (ii) model inputs and (iii) overall conclusion.

Modelling approach

A 3.13 Oxera notes that Vodafone and Mr. Young both provided comments on the modelling approach as summarised below.

A 3.14 Considering Vodafone's comment that overall coverage may be overstated as MNO budgets are partly spent on replacement sites, therefore reducing the level of investment available for new coverage, Oxera notes that:

- its analysis (in section 5.5 of Document 18/103c) is among other things based on a conservative estimate of the percentage of network investment being spent on improving mobile coverage (10–20%); and
- while MNOs may have high levels of operating expenditure (OPEX) on their existing networks, this is unlikely to have a material impact on the level of investment that MNOs would be willing to make in achieving new coverage, as investment decisions regarding future mobile connectivity are likely to be driven by the expected return for that particular investment (rather than by the operating costs of a previous investment).

A 3.15 In relation to Mr. Young's submission suggesting that the modelling approach may underestimate coverage, Oxera is of the view that:

- the positive effects of the 700 MHz band and carrier aggregation are comprehensively considered in the model. In this regard Oxera points to numerous references in its report³⁴²; and
- the model has used reasonable assumptions in relation to technology advancements, 5G and future demand patterns. In this regard, Oxera notes that:
 - these assumptions are based on the likely gradual evolution of the mobile networks in Ireland which is representative of what happens in practice noting that MNOs do not upgrade their networks with the latest technology (e.g. 5G) or features (e.g. beam-forming) all at once. It is more likely that this will happen gradually, and that 4G technology will remain in the coverage

³⁴² Oxera reference sections 4.4, A2.4, 5.1 and 5.5 of its connectivity report.

layer of networks for a number of years to come, similar to the way that 2G and 3G technologies remain in use today; and

- it is reasonable to assume that service providers (i.e. MNOs) will assess the demand carefully and upgrade the network to deliver services in the most efficient way, and that the MNOs have a good knowledge about the end-user demand for services and the cost of delivering those services.

Model inputs

A 3.16 In relation to the inputs used in the model, Oxera notes that there were several comments submitted as summarised below.

A 3.17 Regarding Mr Young's comment querying the likelihood of lower macrosite antenna heights in rural areas compared to urban locations, Oxera is of the view that this model input remains appropriate as:

- the macrosite height assumptions used in its modelling are based on various industry sources, and the aim of the study was to model coverage at a network level as opposed to providing precise coverage for each macrosite;
- a coverage validation exercise was carried out to confirm that the coverage from the synthetic mobile network modelled (which involved calculations based on the assumed antenna height and site locations, etc.) was comparable to other estimates of MNO coverage; and
- the urban topology offers opportunities for relatively high antenna height because of the availability of buildings that reach that height (i.e. rooftop antenna).

A 3.18 In relation to Vodafone's comment that the structural upgrades and associated labour costs are higher than those modelled, Oxera notes that:

- the model is focused on upgrading for coverage, where there is less of a need for structural upgrades, as opposed to upgrading for capacity; and
- the higher site upgrade costs as suggested by Vodafone would not be expected to materially change the simulation results as the estimated costs are mostly driven by the cost of new sites (rather than upgrades).

A 3.19 Considering Vodafone's comment that a small number of areas cannot be served due to a lack of planning permission, Oxera recognises that such

site acquisition failures or notice to quit can be an issue for MNOs in general (as shown by the Mobile Phone and Broadband Task Force), and that this could potentially lead to a small increase in cost. However, in the context of this modelling exercise, Oxera is of the view that this is unlikely to have a significant impact on the overall cost.

A 3.20 Finally considering Vodafone's comment that the speed of roll-out of new sites has decreased since the data set used by ComReg was created, Oxera is of the view that the new site rollout estimates in its report (see Table 5.8 of Document 18/103c) are indeed reasonable, as:

- the roll-out rate is for a synthetic operator and not intended to represent an operator's specific plans. In this regard, Oxera notes that some operators (e.g. new entrants) would have higher new site rollout rates than others (e.g. incumbent operator with near-ubiquitous coverage)
- the new site roll-out site can be adjusted with faster roll-out speeds being more challenging to achieve and resulting in MNOs incurring higher costs (than for a slower network roll-out);
- the average roll-out rate of 2.5% CAGR (compound annual growth rate) determines the maximum number of new sites an operator could roll out in a given year. When site upgrades are deployed, the new site roll-out is reduced accordingly in the model, as operator resources are deployed for the site upgrade. In this regard, Oxera notes that the new site roll-out rate immediately after mid-2020 is considerably lower than the maximum 2.5% CAGR level, as the coverage gains of the synthetic operator are provided primarily through upgrades. This is evident from the results of scenario 2 which show a decreased level of new macrosite roll-out after mid-2020 due to the increased deployment of site upgrades; and
- the recent announcements by Eir imply that the roll-out rate of 2.5% and the associated investment are likely to be achievable.³⁴³

Overall conclusions

A 3.21 Overall, Oxera is of the view that the comments submitted by the respondents do not change its view that the cost modelling is based on robust inputs and assumptions, and that the conclusions and recommendations drawn from them regarding the level of coverage that

³⁴³ Oxera reference Eir's announced investment of €150m over two years which will result in: 'Hundreds of additional mobile base stations and existing sites without 4G capacity will be upgraded to it.'

may occur without intervention are reasonable and justified.

A3.4 ComReg's assessment on views on the Oxera Connectivity Report (Document 18/103c)

A 3.22 ComReg has carefully considered the respondents' views and considers that Oxera has properly considered those submissions, in light of among other things, the information set out in the Oxera Connectivity Report³⁴⁴ and industry sources³⁴⁵ as appropriate.

A 3.23 While ComReg notes that Vodafone presented new costing information, ComReg agrees with Oxera's analysis that this information is unlikely to have a significant impact on the overall costs, as among other things, the main cost in the model is driven by the deployment of new sites rather than upgrades.

A 3.24 Noting the above, and the rationale presented by Oxera, ComReg agrees with Oxera's view that its model approach and its model inputs are appropriate and robust, and the conclusions of the Oxera Connectivity Report remain reasonable.

A3.5 Summary of respondents views to the DotEcon Connectivity Report (Document 18/103d)

A 3.25 Mr. Young provided comments related to the advice in the DotEcon Connectivity Report where, in summary, Mr. Young submits that ComReg should adopt an interventionist approach to setting licence obligations to ensure minimum coverage and download speeds, rather than the precautionary approach favoured by ComReg in its consultation document.

A 3.26 Mr. Young recommends that ComReg should:

- set much more challenging network coverage and minimum download speed conditions than those set out in the consultation document; and
- not allow its approach to the spectrum award to be influenced by the National Broadband Plan (NBP).

A 3.27 Mr. Young also submits that, ComReg's statutory objective regarding

³⁴⁴ For example, Oxera note that Section 5.5 of Document 18/103c employed a conservative estimate of network investment (raised by Vodafone) , and that sections 4.4, A2.4, 5.1 and 5.5 considered the benefits of 700 MHz band and carrier aggregation (raised by Mr Liam Young).

³⁴⁵ For example, industry information is used to inform the height of macrosites and the new site roll-out rate.

maximising the use of Ireland's radio spectrum resources for Irish consumers is unqualified, and ComReg should not be constrained by overlapping plans for fixed network solutions, or by implication ComReg's other statutory objectives and duties.

Interventionist vs precautionary coverage obligations

- A 3.28 Mr. Young suggests that the interests of Irish consumers, taxpayers and in particular, rural mobile broadband (MBB) users are best served by the adoption of an interventionist approach to coverage obligations, rather than the precautionary approach favoured by ComReg in its consultation document, as the rapid roll out of advanced mobile services to rural communities (before or at the same time as urban ones) would in his view be socially beneficial and improve national competitiveness by ensuring Irish businesses and consumers enjoy the benefits of connectivity at least as quickly as those in other countries.
- A 3.29 In addition, Mr. Young submits that an interventionist approach to download speeds and coverage obligations is considered by many regulators to be critical to ensuring that licence holders roll out services quickly, and that radio frequency spectrum is used efficiently and to the maximum benefit of users

International comparisons

- A 3.30 Mr. Young submits that while a balanced approach is required, adopting a precautionary approach risks network equipment vendors and MNOs de-prioritising the roll-out of 5G services in Ireland, as in assessing the international priority with which each market rollout new services, in his view a key consideration will be the regulatory roll-out obligations which must be met.
- A 3.31 Mr. Young also submits that evidence from international studies demonstrated that Ireland lags far behind most developed nations in average mobile data download speeds and is at or below the rural population coverage average of most nations in terms of current 4G LTE coverage. This performance, he argues, demonstrates that the dynamics of competition among licensees in Ireland is unlikely to address the quality of service deficit without significant intervention measures by ComReg.

Sequencing of interventionist obligations

- A 3.32 Mr. Young is of the view that ComReg's consultation document offers no rationale behind the view put forward that *"interventionist obligations are ideally achieved via a sequential step in a spectrum award or through a separate process."* He submits that neither the regulator, the licence holders

nor indeed any other stakeholders would benefit from the uncertainty this would create as to the precise benefits and obligations of the licence at the time of bidding. Further he submits that this could cause potential bidders to assign less value to the licence in light of the prospect of shifting or increasing licence obligations that may or may not arise over time.

A 3.33 Mr. Young believes that the likelihood that MNOs would accept new “sequential” obligations voluntarily once the licence agreement is in place is very low, and he suggests the imposition of new licence obligations post the award process is likely to be too late to address a market failure once it occurs. From a contractual point of view, he states that it seems unlikely that ComReg could unilaterally impose new conditions on a licence that has already been granted, and which would at best, be open to legal challenge.

A 3.34 Mr. Young also states that he is not aware of ComReg previously engaging in post-award changes in licence conditions to address deficits in quality of service performance.

Competition between fixed wireless and mobile operators

A 3.35 Mr. Young submits that it would be remiss of ComReg not to ensure the roll-out of fixed and mobile technologies to their full potential. In support of this view, Mr Young submits that:

- ComReg may need to ensure that its approach is compatible with EU State Aid and EU Competition Rules, since the adoption of a strategy that could be perceived as taking a less than optimal approach to the spectrum licence award, in an effort to avoid or discourage licensees from encroaching on the objectives of the NBP, may be problematic;
- from a rural user’s perspective, both fixed and mobile high-speed broadband technologies should be enabled and incentivized, partly because their use cases and applications are often different, and also because EU Competition Law is based on the premise that the consumer is best served by promoting fair competition between vendors offering different but competing solutions to the fullest extent possible;
- it would seem logical to have an interventionist approach to mobile coverage in the forthcoming award process, since this matches the approach taken in respect of fixed broadband services, and provides the best means of ensuring rapid delivery of high speed MBB services to all parts of the country, and not just those in urban and semi-urban areas;

- while mobile services may not be quite matching the quality of fixed alternatives, they will very likely meet and even exceed the fixed network experience with the launch and maturing of 5G services;
- in relation to voice services, despite arguably a higher quality and reliability of fixed line voice services compared to mobile, users have predominantly chosen mobile because it delivers an acceptable solution in both home and mobile scenarios, and it makes more sense to use and pay for one service rather than two; and
- in relation to broadband services, Mr. Young notes that according to the Digital Economy and Society Index Report 2019 on Connectivity prepared for the European Commission, the proportion of households using MBB alone to deliver their home broadband needs has grown rapidly over the past few years (the average among EU Member States remains under 10%). He states that this trend is expected to continue, partly driven by the relatively high fixed rental element of both fixed and mobile services. Mr Young also states that he believes that it may continue even if the standalone fixed broadband solution is superior in terms of download speeds and reliability.

Methodology used in the Connectivity Studies

- A 3.36 In relation to the methodology used in the Connectivity Studies, Mr. Young believes that none of the reports commissioned by ComReg appear to have adequately considered the strategic and competitive issues facing MNOs in formulating their approach to the forthcoming spectrum awards process, other than the basic financial and economic considerations.
- A 3.37 He submits that this is best exemplified by studying the outcome of the recent German 5G spectrum award process, where higher than expected bids were made by the incumbent MNOs, despite the inclusion of very demanding licence obligations.
- A 3.38 While it remains to be seen whether the bidders have overpaid for the spectrum licences, he believes that there are clearly a number of underlying factors at work in driving experienced MNOs to not only accept the challenging licence obligations, but also bid higher than predicted amounts to secure the licences. While recognising that MNOs are certainly driven by financial and economic considerations, he also believes that they also need to ensure that their business model for growth and competitiveness remains intact and sustainable. He does not believe that a mobile operator that has already invested heavily in previous generations of infrastructure, intellectual property and customer acquisition can easily decide to change

or abandon its course.

A 3.39 Mr Young points out that these previous investments are largely sunk investments, even if they are still very valuable. A mobile network operator without radio spectrum availability into the future risks its sunk investments becoming stranded investments. Consequently, Mr Young's submission strongly recommends that ComReg takes into account his view that the business case for an incumbent MNO to invest in new spectrum does not just involve the economics of an investment relative to its associated return, but also involves other important MNO considerations aimed at protecting and continuing to extract returns from all previous investments, often expressed as goodwill, which he says stretch back in time to the acquisition of its first customer.

A3.6 Summary of DotEcon's assessment

A 3.40 DotEcon's consideration of Mr. Young's views is set out in Document 19/124b, and summarised below.

Interventionist vs precautionary coverage obligations

A 3.41 In considering Mr Young's suggestion that the interests of Irish consumers, taxpayers and in particular rural mobile broadband (MBB) users, are best served by the adoption of an interventionist approach to coverage obligations, DotEcon notes that an efficient outcome for spectrum assignment and use is not the same as simply maximising benefits (speed and coverage) for mobile users without regard to the costs of delivering that outcome.

A 3.42 DotEcon therefore strongly disagrees with Mr Young's suggestion that ComReg's objective of achieving efficient spectrum assignment should be interpreted as an absolute requirement to incur ancillary network investments without limit in order to realise greater coverage from spectrum absent regard to the relative costs and benefits of such investments.

A 3.43 In considering the case for interventionist coverage obligations, DotEcon notes that its previous report (Document 18/103d) did not find any credible *a priori* arguments to suppose that there are large external benefits to obtaining greater coverage, and DotEcon notes that Mr Young has not supplied any additional evidence or arguments to undermine this conclusion.

A 3.44 Nevertheless DotEcon agrees that a case for procuring interventionist

coverage could arise³⁴⁶ and it believes that there is a strong argument to wait and see what competition between network operators can deliver, subject to a precautionary coverage obligation. Subsequently, consideration could be given to intervening selectively to address specific, observed coverage failures if and when they emerge. It believes that this approach is:

- likely to give much better value for money for the taxpayer by allowing interventionist obligations to be designed to maximise benefit relative to cost; and
- particularly appropriate given the high degree of current uncertainty about how 5G services might evolve and what new applications, some of which could be of significant social value.

A 3.45 Finally in relation to the international use, DotEcon notes that European regulators commonly use precautionary coverage obligations, while interventionist coverage obligations are typically used selectively to address specific failures of competition to deliver coverage.

International comparisons

A 3.46 In relation to the international comparisons mentioned by Mr Young, DotEcon notes that (i) these primarily deal with mobile download speeds as opposed to appropriate levels of coverage, and (ii) average 4G availability in Ireland is around the same level of the EU average of 94% of homes.

A 3.47 In relation to Mr Young's assertion that equipment manufacturers and MNOs would de-prioritise 5G rollout in Ireland without interventionist obligations, DotEcon is of the view that:

- there is unlikely to be any significant trade-offs between different countries in terms of which will receive 5G networks first, as equipment manufacturers operate at global scale and as new equipment becomes available it will do so at volume, and it is for MNOs to make network-by-network decisions about upgrading and adoption of 5G; and
- even if there were trans-national competition for investment or network equipment, setting a stringent interventionist coverage obligation would not help Ireland garner additional resources. On the contrary, DotEcon believes that such an obligation would likely

³⁴⁶ For example, if smart transport systems, requiring 5G coverage, become important and there is evidence that competition between MNOs cannot deliver this.

reduce investment returns from network expansion and so disfavour Ireland relative to countries with less onerous obligations.

Sequencing of interventionist obligations

A 3.48 DotEcon notes that the procurement of interventionist coverage obligations is different to the imposition of obligations as suggested by Mr. Young, and in light of this, DotEcon does not think that the procurement of coverage would introduce any additional uncertainty around the value of the license, as successful bidders would be compensated for committing to additional coverage obligations, if they chose to do so.

A 3.49 DotEcon notes that whether or not it is appropriate to use such a procurement mechanism will depend on a consideration of the external benefits from having interventionist obligations in place.

Competition between fixed wireless and mobile operators

A 3.50 At the outset, DotEcon expresses the view that some of Mr. Young's comments in relation to State aid and Competition Law somewhat betray a lack of understanding of those rules. It is not correct that the upcoming award is designed to prohibit MNOs from infringing on the work of the NBP, but rather that the NBP is in place because it has been judged (as part of the design of the NBP process) that it is not viable for the target areas to be served adequately by mobile operators on a commercial basis.

A 3.51 In relation to Mr. Young's view that it would be remiss of ComReg not to set coverage obligations to ensure the roll-out of mobile technologies to its full potential in order to compete with fixed networks, DotEcon notes that Mr Young's assumption fails to consider how we are moving rapidly towards a world in which consumers will experience connectivity and be largely unaware of the underlying network being used to deliver it. 5G standards enable seamless transition between networks, from indoor WIFI connections to outdoor mobile ones. Different networks, therefore, become complementary in contributing to the delivery of seamless connectivity. Given these expected developments, costly intervention to extend mobile networks in order to promote additional switching between fixed and mobile access is not justifiable.

Methodology used in Connectivity Studies

A 3.52 In considering the recent German 5G auction, DotEcon notes that the circumstances of that award offer an explanation of why bids were higher than expected and that this does not suggest that the advice provided to ComReg in relation the effect of coverage obligations on bidders' valuations was inappropriate.

A 3.53 In relation to the circumstances of the German 5G auction, DotEcon notes that:

- *Drillisch Netz, an MVNO prior to the auction, was a successful bidder and competition between Vodafone and T-Mobile for an additional spectrum block continued for much longer than expected, resulting in 497 rounds of bidding. In addition, some spectrum was reserved for regional applications, reducing the overall supply available in the award to the MNOs. This was an auction which featured an unusually high level of competition for a restricted amount of spectrum, so it is unsurprising that this resulted in relatively high bids.;* and
- the German coverage obligations were not that dissimilar (in terms of the burden placed on operators) to the precautionary ones being considered by ComReg, meaning that they were unlikely to have a significant negative effect on valuations.

A 3.54 Finally, in relation to the consideration of sunk costs in spectrum valuation, DotEcon notes that MNOs' ability to recover sunk costs will depend on them maximising profit from this point onwards, and their existence does not alter bidding incentives. Instead bidders will form some valuation based on the profitability of using the spectrum available in this award and this valuation sets their maximum willingness to pay for spectrum. What successful bidders end up paying is determined by the level of competition, so it is perfectly possible that the presence of an entrant in this award leads to relatively high bid amounts, as in the German example.

Conclusions

A 3.55 Overall, DotEcon is of the view that Mr Young has not raised any points to cause it to amend or reconsider the conclusions of its previous report.

A 3.56 DotEcon clarifies that while it did find any credible *a priori* arguments to suppose that the external benefits of procuring interventionist coverage would be large, it agreed that a case could arise, for example, if smart transport systems, requiring 5G coverage, become important and there is evidence that competition between MNOs cannot deliver this.

A 3.57 DotEcon believes that there is a strong argument to wait and see what competition between network operators can deliver, subject to a precautionary coverage obligation, and then consider intervening selectively to address specific, observed coverage failures if and when they emerge. It believes that this approach is:

- likely to give much better value for money for the taxpayer by allowing interventionist obligations to be designed to maximise benefit relative to cost; and
- particularly appropriate given the high degree of current uncertainty about how 5G services might evolve and what new applications may emerge, some of which could be of significant social value.

A3.7 ComReg's assessment on views on DotEcon Connectivity Report (Document 18/103d)

A 3.58 ComReg has carefully considered the respondent's views and the assessment of those views by DotEcon, where among other things, DotEcon notes that:

- an efficient outcome for spectrum assignment and use is not the same as simply maximising benefits (which Mr Young appears to consider as greater network coverage and speed) for mobile users, as suggested by Mr Young, without regard to the costs of delivering that outcome; and
- no additional evidence or arguments have been supplied to undermine this conclusion set out in the DotEcon Connectivity Report.

A 3.59 Noting the assessment set out in Document 19/124b, ComReg is also of the view that no additional points have been raised that would require DotEcon to amend or reconsider the conclusions of its original DotEcon Connectivity Report (Document 18/103c).

A 3.60 Finally, ComReg is of the view that what constitutes maximising benefits for consumers is not simply maximising coverage and speed, without regard to the cost to consumers.³⁴⁷ Indeed, in the extreme, if ComReg mandated sufficiently high speeds and geographic coverage, there would be a crossover point where a greater number of consumers would not be able to afford the charges that operators would have to impose than would gain access as a result of increasing coverage. This would clearly not optimise consumer welfare. Accordingly, a somewhat holistic view needs to be taken to deliver good connectivity and speed at a price level that consumers are willing to pay.

³⁴⁷ In particular, ComReg notes that consumers appear to have a low willingness to pay for additional coverage, see ComReg Document 19/101, "Mobile Consumer Experience survey 2019", published 18 November 2019, and ComReg Document 17/100a, "Mobile Consumer Experience survey" published 6 December 2017.

Annex: 4 Information on equipment availability, award status in Europe, harmonisation decisions and spectrum availability for the candidate bands.

A 4.1 This annex sets out information on the spectrum bands under consideration in this document (both those proposed for award and those not proposed) in the context of:

- the degree of harmonisation;
- equipment availability;
- award status in Europe; and
- the availability of spectrum in Ireland.

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A4.1 Harmonisation status of spectrum bands

A 4.2 The table below provides information on the international harmonisation status of the each of the spectrum bands under consideration in the Proposed Award.

Band	ECC Decision	EC Decision	Other
700 MHz Duplex Band	ECC Decision 15(01) (March 2015)	EC 2016/687	UHF Band EP&C 2017/899
700 MHz Duplex Gap & Guard Bands	ECC Decision 15(01) (March 2015)	EC 2016/687	UHF Band EP&C 2017/899
1.4 Centre Band	ECC Decision (13)03 (Revised March 2018)	EC 2015/750 as amended by EU 2018/661 ³⁴⁸	--
1.4 Extension Bands	ECC Decision (17)06 (November 2017)	EC 2015/750 as amended by EU 2018/661	--
2.1 GHz Band	ECC Decision (06)01 (Revised March 2019)	EC 2012/688 ³⁴⁹	
2.1 GHz Unpaired	-- ³⁵⁰	--	--
2.3 GHz Band	ECC Decision (14)02 (June 2014)	--	--
2.6 GHz Band	ECC Decision (05)05 (Revised July 2019)	EC 2008/477 ³⁵¹	EP&C 243/2012
26 GHz Band	ECC Decision (18)06 (Revised October 2018)	EU 2019/784	Directive (EU) 2018/1972

³⁴⁸ As amended by EC 2018/661. A consolidated version of EC 2015/750 can be found here: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02015D0750-20180430&qid=1551728608784&from=EN>

³⁴⁹ A first draft of an implementing decision to amend Decision 2012/688/EU to make it suitable for 5G was discussed at the Radio Spectrum Committee meeting in December 2019.

³⁵⁰ Regarding harmonisation of the 2.1 GHz Unpaired Band, ECC Decision (06)01 facilitated the use of MFCN in the band, and this was later amended by ECC Decision (15)02, which then harmonised the Unpaired Band for Direct Air-to-Ground Communications. However, ECC Decision (15)02 was later withdrawn by ECC (18)01. <https://www.ecodocdb.dk/download/0bc97406-7dbd/ECCDec1801.pdf>.

³⁵¹ A first draft of an implementing decision to amend Decision 2008/477/EC to make it suitable for 5G was discussed at the Radio Spectrum Committee meeting in December 2019.

A4.2 Equipment availability

A 4.3 The following table provides an update of the number of 4G and 5G devices identified by the GSA (<https://gsacom.com/>) as being capable of operating in each band as at 29 November 2019. The data presented in Document 19/59R represented relevant GSA data as at March 2019.

Band ³⁵²	4G devices March 2019	4G devices Nov 2019	5G devices March 2019	5G devices Nov 2019
700 MHz Duplex (B28, FDD) (n28, FDD)	1,624	2,098	1	12
700 MHz Duplex Gap & Guard Bands (B67, FDD, SDL)	--	--	--	--
800 MHz (B20, FDD) (n20, FDD)	5,550	6,305	--	9
900 MHz (B8, FDD) (n8, FDD)	4,557	5,617	--	6
1.4 GHz Centre (B32, FDD, SDL)	83	123	--	--
1.4 GHz Extensions (B75, B76)	--	--	--	--
1.8 GHz (B3, FDD) (n3, FDD)	9,378	10,735	--	11
2.1 GHz (B1, FDD) (n1, FDD)	7,706	8,905	--	11
2.3 GHz (B40, TDD) (n40, TDD)	4,757	5,479	--	3
2.6 GHz (B7, FDD) (n7, FDD)	8,329	9,351	1	9
(B38, TDD) (n38, TDD)	3,666	4,156	1	4
(B41, TDD) (n41, TDD)	3,538	4,164	4	36
3.6 GHz (B42, TDD) (n77, TDD)	244	279	1	24
(B43, TDD) (n78, TDD)	247	205	6	39
26 GHz (n257, TDD)	--	--	5	5

³⁵² All the bands presented in this table are identified as such by the 3GPP. Also, provided in parenthesis below is the 4G and 5G band number assigned by the 3GPP to each band. At this time, the GSA does not provide any figures for devices capable of operating in bands B67, B75, B76.

A4.3 Status of awards in Europe

A 4.4 The following table shows the status of awards in 20 European countries for the bands under consideration in the proposed award³⁵³.

European Country	700 MHz Duplex	700 MHz SDL	1.4 GHz Centre	1.4 GHz Extension	2.1GHz	2.3 GHz	2.6 GHz	26 GHz
Austria	✓	--	✓	✓	✓✓	--	✓	--
Belgium	✓	--	✓	✓	✓✓	--	✓✓	--
Czech Republic	✓	--	--	--	✓	--	✓	--
Denmark	✓	✓	--	--	✓	✓	✓	--
Finland	✓	--	--	--	✓	--	✓	✓
France	✓	--	--	--	✓	--	✓✓	--
Germany	✓	--	✓	--	✓✓	--	✓	--
Hungary	✓	--	--	--	✓✓	--	✓✓	--
Italy	✓	--	✓	--	✓	--	✓	✓
Netherlands	✓	--	✓	--	✓✓	--	✓	--
Norway	✓	--	--	--	✓✓	--	✓	--
Poland	--	--	--	--	✓	--	✓	--
Portugal	✓	--	--	--	✓	--	✓	--
Romania	✓	✓	✓	--	✓	--	✓✓	--
Slovakia	✓	--	✓	✓	✓	--	✓	--
Slovenia	✓	✓	✓	✓	✓✓	✓	✓	✓
Spain	✓	--	--	--	✓	--	✓	--
Sweden	✓	--	--	--	✓	✓	✓	--
Switzerland	✓	✓	✓	✓	✓	--	✓	--
United Kingdom	✓	✓	✓	--	✓	✓	✓	--

Awarded = ✓

Proposed = ✓

Undecided or No Info. = --

³⁵³ Information is sourced from Cullen International (www.cullen-international.com) (a pay subscription website) unless otherwise stated.

A4.4 Spectrum availability in Ireland

A 4.5 This table set out information on the availability of the spectrum bands under consideration in Ireland.

Band	Licensing status
700 MHz Duplex	RTÉ is currently licensed to provide DTT services in this band. The services are to have migrated out of this band by 4 March 2020.
700 MHz Duplex Gap & Guard Bands	RTÉ is currently licensed to provide DTT services in this band. The services are to have migrated out of this band by 4 March 2020. Some spectrum in this band may be required for BB-PPDR services.
1.4 GHz Centre Band	Unused.
1.4 GHz Extension Bands	Various, including fixed links used by broadcasters, An Garda Síochána, Fire Service, and Electricity Supply Board Networks (ESBN). Licences are annually renewable. As of October 2019, there were 92 fixed links in this band - down from 104 in May 2019.
2.1 GHz Band	<p>Meteor - expires on 11 March 2027:</p> <ul style="list-style-type: none"> ○ 1935-1940 / 2125-2130 MHz ○ 1940-1945 / 2130-2135 MHz ○ 1945-1950 / 2135-2140 MHz <p>Three A Licence – expires on 24 July 2022:</p> <ul style="list-style-type: none"> ○ 1920-1925 / 2110-2125 MHz ○ 1970-1975 / 2160-2165 MHz ○ 1930-1935 / 2120-2125 MHz <p>Three B Licence - expires on 1 October 2022:</p> <ul style="list-style-type: none"> ○ 1965–1970 / 2155–2160 MHz ○ 1925-1930 / 2115-2120 MHz ○ 1975-1980 / 2165-2170 MHz <p>Vodafone - expires on 15 October 2022:</p> <ul style="list-style-type: none"> ○ 1950-1955 / 2140-2145 MHz ○ 1955-1960 / 2145-2150 MHz ○ 1960-1965 / 2150-2155 MHz

³⁵⁴ Licence details viewable at: <https://www.comreg.ie/industry/radio-spectrum/licensing/search-licence-type/mobile-licences/>.

Band	Licensing status
2.1 GHz Unpaired Band	Three's licence in the range 1910–1915 MHz, which expires 1 October 2022.
2.3 GHz Band	<p>Mostly unused.</p> <p>Eir holds 28 licences which span the frequency range: 2307-2327, this is used to provide rural telephone services (RurTel). The locations of these are mostly in Co Donegal with limited use in Co. Galway.</p>
2.6 GHz Band	<p>Unused</p> <p>Coexistence considerations with Aeronautical radars above 2690 MHz</p>
26 GHz Band	<p>There is 1458 MHz of unused spectrum in the 26 GHz Band in the ranges 24250 – 24549 MHz / 25445 – 25557 MHz / 26453 – 27500 MHz.</p> <p>In terms of used spectrum:</p> <ul style="list-style-type: none"> • Fixed Wireless Access Local Area - licensed under SI 79 of 2003 as amended, in the frequency ranges 24605 – 24745 MHz / 25613 – 25753 MHz; • Individual P2P licences - licensed under SI 370 of 2009, in the frequency ranges 25277 – 25445 MHz / 26285 – 26453 MHz; and • ComReg awarded spectrum rights of use for 26 GHz National Block Licences in the frequency range 24745 – 25277 MHz / 25753 – 26285 MHz (see Document 18/53). Licences, which issued on foot of that award under S.I. 158 of 2018, will run for 10 years from their commencement date.

Annex: 5 BB-PPDR considerations and the quantity of 700 MHz Duplex spectrum in Proposed Award

A 5.1 The purpose of this annex is to set out ComReg's assessment of the respondents' views with respect to the Broadband-Public Protection and Disaster Relief (BB-PPDR) matters discussed in Document 19/59R and to provide ComReg's updated view on the quantity of 700 MHz Duplex spectrum to include in the Proposed Award.

A5.1 Summary of ComReg's view in Document 19/59R

A 5.2 In Section 2.3 and Annex 3 of Document 19/59R, ComReg set out information on the spectrum management considerations for BB-PPDR in Ireland. Among other things, this included:

- background information on the 700 MHz Band, the importance of 5G services, the European 'pioneer' 5G bands and PPDR; and
- information on the key findings of the LS telcom BB-PPDR report (ComReg Document 19/59e) which had three main tasks:
 - Task 1: Summarise key points relevant to BB-PPDR network deployment and spectrum options and the amount of spectrum likely to be required to operate BB-PPDR;
 - Task 2: Consider experiences in other European countries and discuss feasibility of different network deployment options; and
 - Task 3: In light of findings from Tasks 1 and 2, comment on the likely spectrum requirements and the relative merits of various spectrum options in Ireland.

A 5.3 Recognising the national flexibility afforded to Member States under the 700 MHz EC Decision in terms of the different uses for the 700 MHz band and, in particular, that the 700 MHz Duplex could be used for both WBB and BB-PPDR services, ComReg's draft spectrum management assessment considered two options:

- to progress the Proposed Award on the basis of including the full 2x30 MHz of the 700 MHz Duplex; or
- to set aside some spectrum (i.e. 2x5 MHz or 2x10 MHz) in the 700 MHz Duplex for potential BB-PPDR use in Ireland (i.e. exclude same

from the Proposed Award) should there be cogent and robust reasons from a spectrum management perspective to warrant same.

- A 5.4 In considering these options, ComReg firstly observed that there are a range of deployment options for BB-PPDR (dedicated, hybrid and commercial), including some which do not require dedicated spectrum, and that approaches involving commercial networks are being considered by many Governments in Europe.
- A 5.5 In the case of a dedicated network, and based on LS telcom's analysis (Document 19/59e), ComReg observed that 2x6 MHz would appear to be sufficient to support BB-PPDR usage in Ireland, and that there are a range of technically viable spectrum options available in Ireland to meet this demand.
- A 5.6 For the 410-430 MHz band, ComReg proposed to make available 2x3 MHz for BB-PPDR, noting that this represents a significant step towards meeting Ireland's likely BB-PPDR spectrum requirement of 2x6 MHz.
- A 5.7 For the 700 MHz Duplex Gap and 700 MHz Guard Bands (3GPP Band 68 (2x5 MHz) and 3GPP Band 28B (2x3 MHz)), ComReg proposed that spectrum in these bands could also be made available for BB-PPDR use if required, in line with the flexibility afforded the State in respect of the use of same under the 700 MHz EC Decision.
- A 5.8 For the 700 MHz Duplex (3GPP Band 28), ComReg noted that there would be substantial negative impacts associated with a reduced availability of spectrum in the 700 MHz Duplex for WBB (i.e. if 2x5 or 2x10 MHz were allocated to BB-PPDR). This was informed by:
- the importance of the 700 MHz Duplex for 5G services;
 - the importance of the 700 MHz Duplex for rural connectivity in Ireland in terms of coverage, speed and network costs; and
 - a reduction in the amount of 700 MHz Duplex spectrum available for WBB would constrain the supply of this spectrum for existing MNOs (perhaps even with an MNO securing none) and also limit ComReg's ability to promote new entry.
- A 5.9 Noting the above, ComReg set out its preliminary view that progressing the Proposed Award on the basis of including the full 2x30 MHz of the 700 MHz Duplex would be the most appropriate option in terms of its spectrum management functions and objectives.

A5.2 Views of respondents to Document 19/59R

A 5.10 ComReg received four submissions (from Eir, Motorola, Three and Vodafone) relating to the BB-PPDR matters discussed in Document 19/59R and the LS telcom BB-PPDR report. These are discussed under the headings below.

Quantum of 700 MHz Duplex in the Proposed Award

A 5.11 Eir, Three and Vodafone agree with ComReg's preliminary view in Document 19/59R that the full 2 × 30 MHz of the 700 MHz Duplex should be included in the Proposed Award, as:

- the LS telcom analysis is comprehensive (Three and Vodafone); and
- spectrum requirements for BB-PPDR can be addressed separately, including through the use of commercial services as is the case in a number of Member States (Eir).

A 5.12 Motorola also agrees that the full 2×30 MHz of 700 MHz Duplex should be included in the Proposed Award, but it also submits that if the 700 MHz Duplex band is foreseen to deliver BB-PPDR services in the near future, then a 2×10 MHz slot should be identified in advance of the award to deliver these services.

A 5.13 In this regard, Motorola suggests that special provisions should be attached to any BB-PPDR spectrum assignment that would prevent a spectrum re-sell and that a “*precautionary-plus*” coverage obligation be attached to the assignment to meet the requirements of BB-PPDR users. It also considers that the Government should be in full control of “*its emergency services spectrum*”.

A 5.14 Motorola also sets out a number of specific comments on ComReg's BB-PPDR spectrum management considerations, as outlined below.

Dedicating spectrum in the 700 MHz Band for BB-PPDR

A 5.15 Motorola suggests that the spectrum and associated standards should be positioned as close as possible to the commercial mass market in order to drive down capital expenditure. As such, it recommends that ComReg focuses on implementations based on 700 MHz Option 2 (2×3 MHz in the Duplex Gap and Upper Guard Band) and/or 700 MHz Option 3 (the 700 MHz Duplex).

A 5.16 Motorola submits that the identification of BB-PPDR implementations in the 700 MHz Duplex would benefit from the state of the art technology that 5G

will bring. Further, Motorola submits that, having been used to deliver DTT services in Ireland previously, the coverage benefits of 700 MHz Band would be an advantage for a BB-PPDR implementation in the band.

The 400 MHz Band and the market for BB-PPDR

- A 5.17 Motorola considers that solutions involving aggregating spectrum (information on which is provided below) across multiple bands are counterproductive and risk making the market for equipment more niche and network deployment more complex. Further, it contends that spectrum options outside of the 700 MHz Band will “...lead to further fragmentation of the BB-PPDR niche market.”
- A 5.18 Motorola submits that care should be taken when comparing the coverage characteristics of UHF Tetra and possible BB-PPDR in the UHF band. Additionally, Motorola submits that despite the recent development of 3GPP specifications for LTE in the 410-430 MHz range, currently there is no ecosystem supporting this band. Motorola also believes that the development of an ecosystem for bands driven by niche markets is relatively slower than in harmonised bands for MFCN.

Other comments

- A 5.19 Motorola agrees that most Governments have made significant investments in their existing narrowband networks and that these networks will continue to operate until any decision is made on a future broadband network. Motorola also agrees that the approach will be influenced by specific national circumstances, equipment availability and the wider International context.
- A 5.20 In relation to the deployment of commercial networks relative to commercial and hybrid models, Motorola contends that the cost considerations set out in bullet two, paragraph 2.23 of Document 19/59R may be speculative. It refers specifically to the statement “*reduced capital and operational costs which otherwise are likely to be substantial*”.
- A 5.21 Motorola also contends that the “*other non-monetary considerations*” mentioned in relation to a commercial network model are not spelled out³⁵⁵. Motorola is of the view that this incorporates the upgrading of a commercial grade network to a standard required for BB-PPDR and believes that this requires expensive upgrades which cannot be incorporated in the business plan of a commercial network.
- A 5.22 In relation to Sweden, Motorola’s understanding is that Sweden “*considers*

³⁵⁵ Bullet three, paragraph 2.23 of Document 19/59R

that awarding the BB-PPDR spectrum to an emergency communications operator is a “Zero-sum-Game”, as the award proceeds later will be charged back to the government for Police and Emergency network subscriptions.” Motorola agrees with the approach being taken by Sweden.

- A 5.23 Further, Motorola believes that, in the event the 2x6 MHz demand calculation is surpassed, it would be more effective to implement BB-PPDR in a single band rather than across bands.

A5.3 Summary of LS telcom’s updated view

- A 5.24 LS telcom’s consideration of the respondent’s views is set out in Document 19/124e. For the purposes of this assessment, a summary is provided below.

Quantum of 700 MHz Duplex in the Proposed Award

- A 5.25 LS telcom notes that the respondents generally agree with ComReg’s proposal to include 2x30 MHz of 700 MHz Duplex in the Proposed Award as was also recommended in the LS telcom report (Document 19/59e).

Dedicating spectrum in the 700 MHz Band for BB-PPDR

- A 5.26 LS telcom notes that Motorola’s comments in relation to this matter have been comprehensively considered in its report and refers to Sections 4.3.3, 4.4, 4.5 and 4.6 of same, where issues such as the significant opportunity costs associated with allocating a portion of the 700 MHz Duplex (Option 3) for BB-PPDR are discussed.
- A 5.27 LS telcom is thus of the view that no update of its report is required to address these comments.

The 400 MHz Band and the market for BB-PPDR

- A 5.28 LS telcom notes that Motorola’s comments in relation to this matter are already addressed in its report. In particular, the review of BB-PPDR deployment and spectrum options (Chapter 2 of Document 19/59e) and the international situation (Chapter 3) indicated that there are a number of potential approaches to deploying BB-PPDR as there are various deployment models (commercial, hybrid, dedicated) and multiple potential frequency ranges that can be used, including the use of the 400 MHz band.
- A 5.29 In relation to the 400 MHz band, LS telcom notes that the use of this band is already considered in its report and LS telcom refers in particular to Section 2.3, Chapter 3 and Section 4.3 of the report.

A 5.30 LS telcom is thus of the view that no update of its report is required to address these comments.

Other Comments

A 5.31 LS telcom notes that the following comments from Motorola are already addressed in its report and thus no further update is required.

- Cost considerations of commercial networks are informed by the costing studies in a number of countries – Denmark, Norway and Sweden – which show that the economic costs of deploying PPDR services on a commercial network are significantly lower than the costs of building a dedicated network. This is discussed in Section 3 of its report.
- Monetary and non-monetary considerations associated with a commercial deployment model are already considered. See for example Figure 3 in Section 2.2.2 of its report.
- Developments in Sweden regarding BB-PPDR spectrum are set out in Section 3.3.13 of its report.

A 5.32 In relation to carrier aggregation, LS telcom notes that this was not discussed in its report, as among other things there is limited information available on the use of carrier aggregation for the delivery of BB-PPDR services. Notwithstanding, LS telcom notes that:

- its conclusion on the technically viable spectrum options for BB-PPDR remains valid (see Options A to F in table 15 of its report); and
- this does not change its observation that options involving the use of the 700 MHz Duplex (Options D, E and F) have significant alternative use impediments as the 700 MHz Duplex band is important for future mobile broadband services and in particular delivering 5G and services to Ireland's rural communities.

LS telcom's overall assessment

A 5.33 Overall LS telcom is of the view that there is no material new information that would necessitate changes to the findings of its report (ComReg Document 19/59e) and no update of the report is therefore required.

A 5.34 LS telcom also confirms that its conclusions regarding the BB-PPDR spectrum options remains as set out in section 5 of its report.

A5.4 ComReg's assessment of respondent's view

A 5.35 ComReg assesses the comments under the following headings and sub-headings:

- Quantum of 700 MHz Duplex in the Proposed Award
- Dedicating spectrum in the 700 MHz Band for BB-PPDR
- The 400 MHz Band and the market for BB-PPDR
- Other comments

Quantum of 700 MHz Duplex in the Proposed Award

A 5.36 ComReg notes that all respondents on this issue agreed with ComReg's proposal to include the entire 2x30 MHz of 700 MHz Duplex in the award.

A 5.37 In relation to Motorola's suggestion that special BB-PPDR provisions be attached to a 2x10 MHz lot in the 700 MHz Duplex should it be foreseen that 700 MHz Duplex spectrum would be used to provide BB-PPDR services in the future, ComReg observes that there is no current proposal that spectrum in the 700 MHz Duplex would be used for BB-PPDR in Ireland.

Dedicating spectrum in the 700 MHz Band for BB-PPDR

A 5.38 The potential for dedicating spectrum in the 700 MHz Band for BB-PPDR was considered by ComReg in Document 19/59R. Having regard to the comprehensive discussions regarding same in the LS telcom report, it was noted by ComReg that, while spectrum in the 700 MHz Band could be favourable for a dedicated BB-PPDR network, the allocation of a portion of the 700 MHz Duplex for BB-PPDR has significant opportunity costs associated with it.

A 5.39 In addition, ComReg noted that there are alternative viable deployment and spectrum options that could be used to provide BB-PPDR services in Ireland. In relation to the BB-PPDR spectrum options, ComReg:

- proposed to make available 2x3 MHz for BB-PPDR in the 410–430 MHz band; and
- noted that spectrum in 700 MHz Duplex Gap and Guard Bands (3GPP Band 68 (2x5 MHz) and 3GPP Band 28B (2x3 MHz)) could also be made available for BB-PPDR in the future.

A 5.40 For the reasons set out in Document 19/59R, ComReg therefore proposed to include the full 2x30 MHz of 700 MHz Duplex spectrum in the Proposed Award.

A 5.41 Noting the above, ComReg considers that Motorola's comments in relation to this matter have already been comprehensively considered by ComReg and LS telcom in Documents 19/59R and 19/59e and does not therefore see any reason to change its proposals based on the Motorola submission.

The 400 MHz Band and the market for BB-PPDR

A 5.42 As detailed in LS telcom's assessment of responses (ComReg Document 19/124e), ComReg observes that the Motorola comments under this heading have already been addressed in the LS telcom report (ComReg Document 19/59e), and that LS telcom is of the view that no further update of its report is necessary.

A 5.43 In addition, ComReg observes that Motorola's comments have already been considered in Document 19/59R, where among other things ComReg noted that:

- there are many different deployment and spectrum options for BB-PPDR and there is no singular approach to provide BB-PPDR services as highlighted by the international analysis which demonstrates the wide range of options being considered by European countries, with many of these considering BB-PPDR spectrum options outside of the 700 MHz Duplex;
- the 410-430 MHz band is a harmonised band which is being considered by a number of EU countries for the delivery of BB-PPDR services, and where one company, Nordic Telecom, has now launched an LTE network for critical communications in the Czech Republic using spectrum rights in the 410-430 MHz band.³⁵⁶

A 5.44 In relation to Motorola's submission on the propagation characteristics of the 410-430 MHz band and the current TETRA band, ComReg notes that while the technology and standards are different, both bands have advantageous propagation characteristics for providing wide area coverage.

Other comments

A 5.45 From the LS telcom assessment of responses (Document 19/124e),

³⁵⁶ <https://www.nokia.com/about-us/news/releases/2019/04/17/nokia-and-nordic-telecom-launch-the-worlds-first-mission-critical-communication-ready-lte-network-in-the-410-430-mhz-band/>

ComReg observes that with the exception of carrier aggregation, which is considered below, all of the other comments submitted by Motorola were already addressed in the LS telcom report (Document 19/59e) and Annex 3 of Document 19/59R.

- A 5.46 In relation to carrier aggregation, ComReg notes that, while this was not discussed in the LS telcom report, LS telcom is of the view that the use of carrier aggregation would not change its conclusion on the technically viable spectrum options for BB-DPPR (see Options A to F in table 15 of its report), or its view that the spectrum options involving the use of the 700 MHz Duplex (Options D, E and F) have significant alternative use impediments.
- A 5.47 ComReg has considered and agrees with LS telcom's view that the use of carrier aggregation does not change the technically viable spectrum options or the opportunity costs associated with the 700 MHz Duplex band, and the overall conclusions of the assessment remain valid.
- A 5.48 Further, ComReg observes that, while carrier aggregation has not yet been standardised between the 410-430 MHz and 700 MHz bands (see for example the 3GPP portal for [specification 3GPP TS 36.101](#)), developments could see carrier more aggregation possibilities in the future. Any such developments would improve the attractiveness of these bands for BB-PPDR.

A5.5 ComReg's updated position.

- A 5.49 In light of the above, ComReg:
- is of the view that its draft spectrum management assessment (as set out in Annex 3 of Document 19/59R) remains appropriate in terms of its spectrum management functions and objectives; and
 - remains of the preliminary view that the Proposed Award should progress on the basis of including the full 2x30 MHz of the 700 MHz Duplex.

Annex: 6 Draft RIAs – Spectrum for Award & Assignment Process

A6.1 Introduction

A 6.1 In Chapter 3 of Document 19/59R, ComReg set out its preliminary view that the inclusion of the 700 MHz Duplex, 1.4 GHz Centre Band, 2.1 GHz, 2.3 GHz and 2.6 GHz bands in the Proposed Award should be considered further in a Regulatory Impact Assessment (RIA).

A 6.2 In Chapter 4 of Document 19/59R, ComReg set out its draft RIAs on:

- which, if any, of the 700 MHz Duplex, 1.4 GHz Centre Band, 2.1 GHz Band, 2.3 GHz Band and 2.6 GHz Band should be included in the Proposed Award; and
- in light of the preferred option arising from the above RIA, how best to assign the rights of use in the relevant band(s).

A 6.3 In addition, Chapter 4 of Document 19/59R set out ComReg's preliminary assessment of the preferred option arising from the two draft RIAs (the "Preferred Option") against ComReg's relevant statutory functions, objectives and duties (including the application of regulatory principles).

A 6.4 Taking account of the views of respondents to Document 19/59R and other relevant updates, this Annex sets out ComReg's updated draft RIAs and assessment of the preferred option against its relevant statutory functions, objectives and duties.

A6.2 RIA Framework

A 6.5 In general terms, a RIA is an analysis of the likely effect of a proposed new regulation or regulatory change, and, indeed, of whether regulation is necessary at all. A RIA should help identify the most effective and least burdensome regulatory option and should seek to establish whether a proposed regulation or regulatory change is likely to achieve the desired objectives, having considered relevant alternatives and the impacts on stakeholders. In conducting a RIA, the aim is to ensure that all proposed measures are appropriate, effective, proportionate and justified.

Structure of a RIA

A 6.6 As set out in ComReg's RIA Guidelines³⁵⁷, there are five steps in a RIA. These are:

- Step 1: Identify the policy issues and identify the objectives.
- Step 2: Identify and describe the regulatory options.
- Step 3: Determine the impacts on stakeholders.
- Step 4: Determine the impacts on competition.
- Step 5: Assess the impacts and choose the best option.

A 6.7 In the following sections, ComReg identifies the specific policy issues to be addressed and relevant objectives for the Proposed Award (i.e. Step 1 of the RIA process). This results in the identification of two fundamental policy issues which are then considered in two separate RIAs following Steps 2 to 5 above of ComReg's RIA process.

A 6.8 Before moving on to Step 1 of the RIA, ComReg first makes some relevant observations below on the stakeholders involved and on ComReg's approach to Steps 3 and 4.

Identification of stakeholders and approach to Steps 3 and 4

A 6.9 The focus of Step 3 is to assess the impact of the various regulatory options on stakeholders. A precursor to the subsequent steps in the RIA, therefore, is to identify the relevant stakeholders. Stakeholders consist of two main groups:

- i. consumers (for the purposes of this draft RIA, consumers include both business and residential consumers), and
- ii. industry stakeholders.

A 6.10 There are a number of key industry stakeholders in relation to the matters considered in this chapter:

- existing service providers who have spectrum rights of use in the bands being considered for inclusion in the award (2.1 GHz Licensees³⁵⁸);

³⁵⁷ See Document 07/56a – Guidelines on ComReg's approach to Regulatory Impact Assessment – August 2007.

³⁵⁸ Meteor Mobile Communications Ltd, Three Ireland Hutchison Limited, Vodafone Ireland Limited.

- Mobile Virtual Network Operators (MVNOs);
- parties who currently provide services using other spectrum rights (licensed or licence-exempt) for whom the spectrum being considered for inclusion in the Proposed Award may be of particular interest to satisfy existing and potential demand (e.g. mobile network operators (MNOs) or fixed wireless access operators (FWA operators); and
- potential new entrants who do not currently provide any services using radio spectrum in the State. This group may include companies that are already otherwise engaged in the electronic communications sector in the State, in other Member States or further afield (new entrants). The focus of Step 4 is to assess the impact on competition of the various regulatory options available to ComReg. In that regard, ComReg notes that it has various statutory functions, objectives and duties which are relevant to the issue of competition.

A 6.11 Of themselves, the RIA Guidelines and the RIA Ministerial Policy Direction³⁵⁹ provide little guidance on how much weight should be given to the positions and views of each stakeholder group (Step 3), or the impact on competition (Step 4). Accordingly, ComReg has been guided by its statutory objectives which it is obliged to seek to achieve when exercising its functions. ComReg's primary statutory objectives in managing the radio frequency spectrum, as outlined in Annex 2, include:

- the promotion of competition;
- contributing to the development of the internal market; and
- the promotion of the interests of users within the Community.

A 6.12 In this document, ComReg has adopted the following structure in relation to Step 3 and Step 4 – the impact on industry stakeholders is considered first, followed by the impact on competition, followed by the impact on consumers. This order does not reflect any assessment of the relative importance of these issues but rather reflects a logical progression. In particular, a measure which safeguards and promotes competition should also, in turn, impact positively on consumers. In that regard, the assessment of the impact on consumers draws substantially upon the assessment carried out in respect of the impact on competition.

³⁵⁹ See Policy Direction Number 6 in Annex 2

A6.3 Identify the policy issues and identify the objectives (Step 1)

Policy issues

A 6.13 As noted at the beginning of this Annex, a number of bands could reasonably be considered for inclusion in the Proposed Award (the Candidate Bands) including:

- Bands which are currently unused in Ireland:
 - The 2.6 GHz Band is unused and available for use.³⁶⁰
 - The 2.3 GHz Band is largely unused and available for use³⁶¹.
 - The 1.4 GHz Centre Band is available for use.
- Bands in which rights of use are due to expire before the proposed award.
 - RTÉ is Ireland's public service broadcaster, and is the current licence holder for Licences for Digital Terrestrial Television Multiplexes using 700 MHz rights of use.
 - It has now been established that the 4 March 2020 is the date by which DTT services are to be migrated from the 700 MHz Duplex in Ireland and the date from which the 700 MHz Duplex is to be available for the provision of ECS/WBB services.
- Bands in which rights of use are due to expire after the Proposed Award. In particular, existing rights of use in the 2.1 GHz Band begin to expire in 2022. For example,
 - Three's "A licence" expires on 24 July 2022, and its "B Licence" expires on 1 October 2022;
 - Vodafone's rights of use expire on 15 October 2022; and
 - Eir's rights of use expire on 11 March 2027.

A 6.14 ComReg is of the view that there are two primary policy issues to be considered in the Proposed Award:

- a) which, if any, of the above bands should be included in the Proposed Award; and

³⁶⁰ Licences issued in the 2.6 GHz Band for MMDS expired in full on 18 April 2016.

³⁶¹ There are currently 28 licences issued to Eir in the 2.3 GHz Band under S.I. 370 of 2009 (Radio Links) and all licences are within the frequency range 2307-2327 MHz.

b) in light of (a) how best to assign rights of use in the Proposed Award.

A 6.15 In relation to (a), for the reasons set out below, ComReg believes that there are certain bands, namely the 2.6 GHz and 700 MHz Duplex bands, which are clearly suitable for inclusion in the Proposed Award (see below) (and indeed favoured for inclusion by respondents to Document 18/60 and Document 19/59R) and that there is therefore no need to consider their inclusion separately in this draft RIA. Instead, this draft RIA only considers the potential inclusion of the other Candidate Bands noted above alongside the 2.6 GHz and 700 MHz Duplex bands in the Proposed Award.

2.6 GHz Band

A 6.16 As noted in Document 18/60 and Document 19/59R, ComReg believes that there are good reasons for including the 2.6 GHz Band in the Proposed Award. In particular:

- it is harmonised at both EU and CEPT level, with the 2.6 GHz EC Decision requiring that all Member States designate and subsequently make available on a non-exclusive basis the 2.6 GHz Band for terrestrial systems capable of providing ECS;
- there is a very strong device ecosystem for this band (see Annex 4);
- it is widely used in other Member States for the provision of WBB including International Mobile Telecommunications (IMT)³⁶²;
- it is available for immediate assignment; and
- all respondents to Document 18/60 and six respondents to Document 19/59R supported the inclusion of this band.

A 6.17 Therefore, ComReg is of the preliminary view that the 2.6 GHz Band is clearly suitable for inclusion in the Proposed Award, particularly when combined with the 700 MHz Duplex discussed below, and should therefore be included in all options discussed in this draft RIA.

700 MHz Duplex

A 6.18 The 700 MHz Duplex is the only Candidate Band capable of providing wide

³⁶² The 2.6 GHz Band is the second most used spectrum band for LTE and LTE-Advanced services worldwide (count of networks using each spectrum band to deliver commercial services).
Source: LTE Frequency Bands Worldwide – January 2019 Global mobile Suppliers Association – GSA

area coverage that is available for release in the proposed time period.³⁶³ It is highly complementary to the 2.6 GHz Band (and other Candidate Bands) as its inclusion provides interested parties with the opportunity to obtain rights of use to coverage and capacity spectrum in the same award which also provides greater opportunities for new entry. In addition:

- the 700 MHz Duplex has been harmonised for providing WBB ECS³⁶⁴:
- it has been established that 4 March 2020 is the date by which the 700 MHz Duplex will be available in Ireland,³⁶⁵ and
- as of November 2019, the GSA identified 2,059 devices³⁶⁶ capable of operating in this band³⁶⁷.

A 6.19 Further, and subsequent to the publication of Document 14/101, ComReg commissioned Frontier Economics to conduct a Cost Benefit Analysis (Frontier CBA) on the release of the 700 MHz Duplex.³⁶⁸ This analysis concluded that the network cost savings to all MNOs (should they secure such spectrum in an award) to be of the order of €89 million in the base case scenario and between €50m and €150m, respectively, in the low and high demand scenarios, arising due to the network cost savings as a result of requiring fewer base stations. This would also improve the performance of networks³⁶⁹, ultimately to the benefit of consumers.

³⁶³ The 1.4 GHz Centre Band offers similar propagation characteristics to sub-1 GHz spectrum, when paired with low frequency spectrum (such as 700 MHz spectrum). This additional capacity would supplement a basic coverage layer provided by spectrum below 1GHz. However, this band does not provide wide area coverage in its own right.

³⁶⁴ See Chapter 2 and Annex 5 as to why ComReg is of the preliminary view that it would not be appropriate to reserve 700 MHz Duplex spectrum for use for BB-PPDR.

³⁶⁵ In that regard, ComReg notes that the Minister for Communications, Climate Action and Environment in a letter of entrustment to RTE to provide for the migration of Broadcasting Services from the 700 MHz band noted that “*The timely release of this spectrum is a matter of national importance as its subsequent use for mobile broadband services will assist in delivery of improved network coverage and speed particularly in rural areas.*”

<https://www.dccae.gov.ie/en-ie/communications/publications/Pages/Migration-from-700-MHz-Spectrum-Band.aspx>

³⁶⁶ GSA – GAMBoD – LTE devices

³⁶⁷ Note that this figure has increased since the publication of Document 19/59R, where the GSA in May 2018 reported that 1,450 devices were available in the 700 MHz Duplex, (Band 28).

³⁶⁸ Frontier Economics, ‘A cost benefit analysis of the change in use of the 700 MHz radio frequency band in Ireland’, published June 2015.

<https://www.comreg.ie/publication/a-cost-benefit-analysis-of-the-change-in-use-of-the-700-mhz-radio-frequency-band-in-ireland/>

³⁶⁹ 700 MHz Duplex spectrum could be used to increase network performance in two different ways.

- it may enable larger blocks of contiguous sub-1GHz spectrum which could be used to significantly increase performance; and
- operators could increase performance in parts of their networks by increasing capacity, and thereby reducing utilisation.

- A 6.20 The Frontier CBA also described wider economic and societal benefits that would likely result from the assignment of the band, including consumer welfare benefits in the form of improved and/or lower cost services and increased demand for mobile services stimulated by greater network capacity. For example, an Oxera Report commissioned by ComReg and published in November 2018 notes that from mid-2020, the commercial extension of a mobile network is likely to switch to a focus on extending higher-speed connectivity (e.g. minimum 30Mbit/s population coverage) partly because 700 MHz Duplex rights of use become available, which will also more readily enable three-band Carrier Aggregation³⁷⁰ (a key technology that will reduce the cost of extending high-speed connectivity).^{371,372} In effect, these gains could not be realised absent the assignment of 700 MHz Duplex rights of use and no additional alternative rights of use are currently available to support such potential gains.
- A 6.21 Accordingly, ComReg is of the view that the 2.6 GHz and 700 MHz Duplex bands are clearly suitable for inclusion in the Proposed Award and should therefore be included in all options discussed in this draft RIA.
- A 6.22 In light of the above, ComReg is of the view that the two primary policy issues to be addressed are:
- a) whether to include the 1.4 GHz Centre Band, 2.1 GHz Band and/or 2.3 GHz band (Candidate Bands) with the 2.6 GHz and 700 MHz Duplex bands in the Proposed Award (the “**Spectrum for Award RIA**”); and
 - b) in light of (a) how best to assign rights of use in the Proposed Award (the “**Assignment Process RIA**”).
- A 6.23 These two important policy issues, while related, are sequential in nature and are each in turn considered under Steps 2 to 5 of the RIA process below. However, before doing so, it is relevant to note the objectives ComReg is seeking to achieve with the Proposed Award.

Objectives

- A 6.24 The focus of this draft RIA is to assess the impact of the proposed measure(s) (see regulatory options below) on industry stakeholders, and on

³⁷⁰ Carrier Aggregation of 2x10 MHz of 700MHz spectrum, 2x10 MHz of 800 MHz spectrum, and 2x10 MHz of 900 MHz spectrum

³⁷¹ Section 5.5.1, Oxera, 'Future mobile connectivity in Ireland', Published November 2018. <https://www.comreg.ie/publication/future-mobile-connectivity-in-ireland/>

³⁷² The anticipated switch to 30 Mbit/s connectivity is also a product of the fact that the costs of providing 3 Mbit/s coverage for the last few percentage points of population rises exponentially. Given this, an MNO would be able to cover a significant proportion of the population with 30Mbit/s for the same cost as expanding 3 Mbit/s coverage to the last few percentage points of population.

competition and consumers. In that way, it allows ComReg to identify and implement the most appropriate and effective means to assign spectrum rights of use, while still allowing ComReg to achieve its objectives of:

- assigning liberalised rights of use in the 700 MHz Duplex and 2.6 GHz Band in line 700 MHz EC Decision (EU 2016/687) and 2.6 GHz EC Decision (2008/477/EC);
- assigning liberalised rights of use in one or more the Candidate Bands, if appropriate, in line with relevant EC Decisions;
- promoting competition and ensuring that there would be no distortion or restriction of competition in the electronic communications sector;
- encouraging efficient investment in infrastructure, promoting innovation and ensuring the efficient use and effective management of the radio frequency spectrum;
- providing further clarity on the likely availability of spectrum for release in other relevant bands; and
- promoting the economic development of the State and electronic communications sector.

A 6.25 ComReg also aims to design and carry out this assignment process in accordance with its broader statutory objectives (set out in Annex 2), including, but not limited to, the promotion of competition in the electronic communications sector.

A 6.26 ComReg's other overarching objectives are to contribute to the development of the internal market and to promote the interests of users within the Community. ComReg also notes that, in achieving its objectives, its ultimate aim is to choose regulatory measures which maximise the benefits for consumers in terms of price, choice and quality.

A6.4 The 'Spectrum for Award' RIA

A 6.27 As noted in the previous section, ComReg is of the preliminary view that the 2.6 GHz and 700 MHz Duplex bands are clearly suitable for inclusion in the Proposed Award and should therefore be included in all options discussed in this draft RIA. For ease of reference, the 2.6 GHz and 700 MHz Duplex bands are hereafter referred to as the "**Primary Bands**". Accordingly, this draft RIA assesses each of the remaining Candidate Bands in terms of the impact their inclusion, or otherwise, with the Primary Bands would have on stakeholders, competition and consumers. ComReg then forms a

preliminary view on which bands, if any, should be included with the Primary Bands in the Proposed Award.

Identify and describe the regulatory options (Step 2)

A 6.28 An assessment of the Primary Bands and each of the remaining Candidate Bands together leads to a large number of potential individual options. However, ComReg notes that it is unnecessary to assess each and every potential combination of bands as a separate option for the purposes of this draft RIA, because the arguments for and against including each Candidate Band with the Primary Bands is essentially the same for any other potential combination of that Candidate Band with other Candidate Bands. Therefore following Option 1 (i.e. inclusion of the Primary Bands only) each subsequent option involves the addition of a particular candidate Band with the Primary Bands.

A 6.29 In light of the preceding discussion, and having regard to responses received to Document 18/60 and Document 19/59R, ComReg has identified the following regulatory options for consideration in this draft RIA:

- **Option 1** - Assign rights of use for 700 MHz Duplex and 2.6 GHz Band only.
- **Option 2** - Include the 2.3 GHz Band in any award process assigning rights of use in the 700 MHz Duplex and 2.6 GHz Band.
- **Option 3** - Include the 2.1 GHz Band in any award process assigning rights of use in the 700 MHz Duplex and 2.6 GHz Bands.
- **Option 4** - Include the 1.4 GHz Centre Band in any award process assigning rights of use in the 700 MHz Duplex and 2.6 GHz Bands.

Impact on industry stakeholders, competition and consumers (Steps 3 and 4)

A 6.30 The focus of this section of the draft RIA is to assess the impact of the aforementioned regulatory options on:

- i. industry stakeholders (being existing stakeholders and potential new entrants);
- ii. competition; and
- iii. consumers.

A 6.31 Prior to carrying out this analysis, ComReg first briefly sets out some background information concerning developments in the demand for

spectrum in Ireland.

Demand for spectrum

A 6.32 Consumer demand for mobile broadband has grown significantly in recent years. Total mobile traffic has grown over 13 times³⁷³ since the 2012 Multi-Band Spectrum Award (2012 MBSA) when 3G was expanded across the country using UMTS 900 and 4G was launched in Ireland. Further, in 2018 ComReg commissioned Frontier Economics to publish a new mobile data traffic forecast to enable better network planning by operators and assist stakeholders to keep pace with consumer demand for services (Document 18/35).³⁷⁴ Frontier forecasts that demand for mobile data in Ireland will grow at an average of 32% per year up to 2022.³⁷⁵ Similarly, LTE fixed wireless broadband is forecast to grow by 26% per year through to 2022.³⁷⁶

A 6.33 Frontier separately notes that there are many factors increasing demand for data including that:

- devices are becoming increasingly sophisticated;
- consumers are using more heterogeneous and sophisticated software and applications on their devices;
- broadband networks are increasingly used by consumers to watch content that would previously have been transmitted over traditional TV networks; and
- business applications continue to drive demand.

A 6.34 These drivers are all described in more detail in Section 2.2 of the Frontier Report on meeting consumers' connectivity needs.³⁷⁷

A 6.35 Demand for spectrum exists to satisfy requirements in both rural and urban areas, and a mix of spectrum bands is typically required for optimal network configuration and where possible to facilitate new entry. While mid frequency spectrum has greater capacity capabilities compared to low frequency spectrum, the latter offers substantial coverage benefits and is more cost-effective in providing 'capacity in the coverage layer' for mobile data services. The 700 MHz Duplex is likely to be central to providing mobile coverage in rural areas and along terrestrial routes where the capacity

³⁷³ ComReg Quarterly Reports –2013 – Q3 2019.

³⁷⁴ Implementing Action 33 of the Mobile Phone and Broadband Taskforce.

³⁷⁵ Document [18/35](#), Mobile Data Traffic Forecast in Ireland, published 27 April 2018.

³⁷⁶ https://www.rcrwireless.com/20180425/5g/fixed-wireless-broadband-to-grow-30-in-2018_tag41

³⁷⁷ Meeting Consumers' Connectivity Needs a report from Frontier Economics, Document 18/103b

requirements are typically less. Ireland is one of the most rural countries in the EU 28³⁷⁸ and the 700 MHz Duplex is likely to be of most interest in Ireland in terms of providing or improving mobile coverage, given that its strong propagation qualities support more cost-effective approaches to the coverage of distributed and rural populations.³⁷⁹

- A 6.36 Capacity is also likely to be an issue particularly in urban and suburban areas where populations are becoming increasingly concentrated. Population growth is projected to be greatest in and around the major cities and Dublin in particular. For example, since the 2012 MBSA, the population of Dublin has grown by around 100,000³⁸⁰ and is forecast to grow by 300,000 in the period up to 2040.³⁸¹ Further, around 90,000 persons (net) travel to work in Dublin from outside and another 70,000 (net) travel to work into the other cities from outside areas. The five urban areas combined accounted for 41% of all daytime workplace destinations (excluding mobile workers).³⁸² This increasing density of population, particularly in urban areas, will put pressure on the capacity of existing networks, whether mobile or fixed.
- A 6.37 MNOs and FWA operators together have significant spectrum portfolios with 750 MHz currently assigned for WBB in Ireland. However, given the mobile data forecasts described above, additional spectrum rights across different bands are likely to be required in the future, and respondents to this consultation process have indicated as much (see discussion in Chapter 3 of Document 19/59R). In light of the above characteristics and developments, demand for suitable radio spectrum in Ireland is likely to be high.
- A 6.38 ComReg sets out below a comparative analysis of each of the four regulatory options outlined above, in terms of their impact on stakeholders, competition and consumers.

Impact on Industry Stakeholders

- A 6.39 As noted above, industry stakeholders can be broadly split between those operators that are currently active in the electronic communications sector and potential new entrants to the electronic communications sector in the State.

³⁷⁸ Section 4.1.1 Document 18/35, Mobile Data Traffic Forecast in Ireland, published 27 April 2018.

³⁷⁹ See Section 2.4, Document 18/103c 'Future Mobile Connectivity in Ireland a report from Oxera Consulting LLP, with Real Wireless Ltd.'

³⁸⁰ Census 2016.

³⁸¹ ESRI, 2018, 'Prospects for Irish Regions and Counties: Scenarios and Implications' Research Series Number 70.

³⁸² Census of Population 2016 – Profile 6 Commuting in Ireland.

A 6.40 ComReg notes that each of the regulatory options below involves additional spectrum being made available for assignment to existing operators or new entrants. Therefore, before assessing each of the options, ComReg sets out below the main reasons why operators, all else being equal, would prefer options which make available additional spectrum rights of use.

Benefits of additional spectrum to stakeholders

Fixed Wireless

A 6.41 While the Candidate Bands above 1 GHz are often used for the provision of capacity on mobile networks, these bands can also be used by a fixed wireless network to deliver coverage and capacity³⁸³. For example, Plum notes:

"the CPE antennas used in fixed networks are also directional and are mounted externally, typically on a rooftop or other elevated position. Once again the antenna gain leads to an increase in the tolerable path loss, but there is also a further benefit in that there is a much higher probability of a line of sight path between the base station and antenna than would be the case for a mobile network, where user terminals are often shielded by buildings, trees and other clutter. This means that a reliable service can be provided over much larger distances than would be the case for a mobile network, especially in an urban or suburban environment".³⁸⁴

A 6.42 In terms of the coverage range for the Candidate Bands, propagation loss increases with the frequency. While there are propagation differences between the 2.1 GHz Band, 2.3 GHz Band³⁸⁵ and 2.6 GHz Band, these are not significant and are typically treated the same for network planning studies.³⁸⁶

A 6.43 The addition of any of these bands would give additional capacity and coverage benefits to existing FWA operators. For example, based on its

³⁸³ For example, DotEcon notes that frequencies above 1 GHz may be attractive for fixed wireless providers, for which capacity and throughput can be achieved using bands with larger amounts of contiguous spectrum. See Chapter 2 of Document 19/59a.

³⁸⁴ Document 15/140d - Technical advice by Plum Consulting concerning potential rights of use in the 3.6 GHz band Updated Report 3: Analysis of the potential spectrum requirements for NGA services.(p53).

³⁸⁵ FDD assignments can cover a wider coverage area. Assuming the same transmit power, the main reason for reduced coverage is that the uplink device power is used part of the time for TDD but continuously for FDD.

³⁸⁶ Report ITU-R M.2292-0 (12/2013) - Characteristics of terrestrial IMT-Advanced systems for frequency sharing/ interference analyses – Table 3.

previous analysis, Plum³⁸⁷ recommended that 100 MHz³⁸⁸ is necessary to provide a high speed (30 Mbit/s or more) broadband service with similar contention levels to existing cable services and a similar infrastructure density to existing wireless services. The 2.3 GHz Band provides FWA operators with the opportunity to increase existing holdings closer to or beyond 100 MHz and compete to a greater extent with existing fixed line services.

A 6.44 Download requirements for FWA broadband services are significantly higher per user compared to mobile. For example, monthly data usage per FWA is around 125 GB per month compared to around 7 GB and 31 GB for smartphone and dongles, respectively.³⁸⁹ In February 2019, Imagine announced plans to deploy approximately 325 sites and provide fixed wireless services across large parts of the country.³⁹⁰ Therefore, depending on FWA subscriptions in a particular area, the need for additional spectrum for such purposes could increase in the future.

Mobile and Fixed Wireless

A 6.45 Assigning available substitutable spectrum in a single award rather than in one or more sequential awards would, among other things, better facilitate the planning of spectrum portfolios to address growth in data traffic and, in turn, enhanced services by successful participants in the Proposed Award. Operators typically have three options when increasing capacity on their networks:

1. deploy more spectrum on existing base stations;
2. add more bases stations thereby increasing the geographic reuse of spectrum; and/or
3. increase spectrum efficiency (i.e. increasing the throughput capacity of each MHz of spectrum).

A 6.46 Increased spectral efficiency is generally achieved through on-going technological advancements and operators are generally dependent on

³⁸⁷ Document 15/75, A Report for ComReg, Technical advice concerning potential sub-national rights of use in the 3.6 GHz band. Report 3: Analysis of the potential spectrum requirements for NGA services.

³⁸⁸ The 100 MHz uses an infrastructure density comparable to one of today's mobile cellular networks, and Plum state that this amount of spectrum utilising LTE-A could serve up to 30% of all broadband subscribers in a typical suburban area and up to 50% of all subscribers in more rural areas.

³⁸⁹ ComReg Quarterly Reports, Q3' 2019. Document 19/112.

³⁹⁰ <https://www.irishtimes.com/business/technology/imagine-plans-300m-wireless-broadband-network-1.3792296?mode=sample&auth-failed=1&pw-origin=https%3A%2F%2Fwww.irishtimes.com%2Fbusiness%2Ftechnology%2Fimagine-plans-300m-wireless-broadband-network-1.3792296>

equipment manufacturers and handset upgrades to provide for same.³⁹¹ More generally, the capacity available to provide MBB services depends on the amount of spectrum assigned to an operator and the number of base stations in its network. Once the existing capacity is fully used, operators must, in the absence of suitable additional spectrum, add more base stations to their network to address congestion.³⁹² This allows radio spectrum to be reused for multiple simultaneous transmissions within the cell area.

- A 6.47 However, the construction of base stations deploying more radios and antennas as well as extending additional backhaul links to new sites is expensive and typically costs substantially more (in the order of multiples) than adding additional spectrum rights to existing base stations.³⁹³ Therefore, depending of course on the relative cost of spectrum in a competitive award, operators are likely to prefer the release of additional spectrum in order to reduce costs of providing additional capacity. Further, with advances in radio technology, including the use of higher bandwidth channels (such as the 2x20 MHz channels available with LTE) and the use of carrier aggregation, having a larger spectrum holding allows an MNO to offer higher headline speeds and sustain higher actual speeds.³⁹⁴
- A 6.48 The release of additional bands also provides greater opportunity for carrier aggregation across bands which makes more efficient use of spectrum by combining two or more bands into a single channel. Carrier aggregation can combine spectrum both within a single band and across multiple bands. The resulting higher peak data rates give users a richer mobile broadband experience and improved service coverage.

Option 1 v Option 2 (inclusion of the 2.3 GHz Band with the Primary Bands)

- A 6.49 While stakeholders are likely to be in favour of Option 1, some stakeholders may also prefer the inclusion of the 2.3 GHz Band in light of the benefits of

³⁹¹ As technology standards are improved and refined the effective capacity of different technologies improves. However, even if new LTE releases are deployed in the network there may be a lag in the user adoption of handset technology with the latest LTE releases. Therefore operators typically do not rely on such developments to increase capacity, particularly in the short run.

³⁹² This is done by deploying more radio towers/antennas and shrinking the reach of each tower by reducing the radiated power of its radio transmissions. This allows radio spectrum to be reused for multiple simultaneous transmissions within the geographic area. Thus by subdividing cells, the amount of traffic that a Hz of spectrum can carry within an overall geographic area (measured by bps/km²) is increased.

³⁹³ For example, the estimate networks costs in the Oxera Report (Document 18/103c Section A.2.4.10) indicates a difference in capex costs. For a new site the estimated capex cost is €250,000, compared to €10,500 for upgrading a site.

³⁹⁴ The actual speeds depend upon a number of factors including the device capability, the network capability, the network capacity available (and congestion) and the RF quality of the connection.

additional spectrum described above. ComReg first sets out information on the band and then assesses how that information would likely inform the views of stakeholders:

- the inclusion of the 2.3 GHz Band (and other bands) would provide additional spectrum and also more contestable spectrum to different potential users;
- the inclusion of the 2.3 GHz Band would provide the opportunity to acquire additional TDD (unpaired) spectrum rights to address asymmetric traffic flows and more effectively manage increased capacity from end users.³⁹⁵ For example:
 - overall average traffic asymmetry ratio (Uplink (UL)/ Downlink (DL)), which is currently dominant (from 1/4 to 1/9) in favour of DL is expected to increase in favour of DL (from 1/7 to 1/10 or more) due to growing demand for audio-visual content³⁹⁶; and
 - the 2.3 GHz Band could be used to deliver extra capacity primarily in the DL direction for more densely populated areas providing better flexibility for operators.
- unlike Supplementary Downlink (“SD”)³⁹⁷ bands, 2.3 GHz TDD spectrum can accommodate both uplink and downlink, and can be used in its own right independent from other frequencies;
- of the 134 smartphones tested by ComReg as part of its handset testing³⁹⁸, 88 handsets support the 2.3 GHz Band, including the most popular Apple and Samsung devices;
- the technical conditions for the 2.3 GHz Band are harmonised in Europe by CEPT and there are significant deployments outside of Europe³⁹⁹ resulting in availability of equipment and a strong device ecosystem⁴⁰⁰;

³⁹⁵ The use of TDD spectrum provides operators the flexibility to adjust its uplink-downlink ratio to account for more downlink capacity once any uplink requirements are satisfied in line with traffic asymmetry. This flexibility is not available with FDD.

³⁹⁶ https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2370-2015-PDF-E.pdf

³⁹⁷ SDL is a mobile broadband system, which by means of base station transmitters in a network uses unpaired spectrum in the downlink direction to provide supplemental downlink capacity, where the downlink resource is constrained due to the asymmetry in data usage.

³⁹⁸ Mobile Handset Performance – Data, Document 18/82, published 19 September 2018.
Mobile Handset Performance – Voice, Document 19/110, published 11 December 2019.

³⁹⁹ Including China, the Asia Pacific region, Africa and Australia.

⁴⁰⁰ As of November 2019 the GSA identify that the 2.3 GHz Band (Band 40) has 5,428 devices available. Source: <https://gsacom.com/>

- beamforming is of particular interest for LTE-TDD because the same frequency is used in the downlink and uplink, whereas FDD requires two separate communications channels. The 2.3 GHz Band is the lowest frequency band suitable for highest capacity 8T8R (8 Transmit 8 Receive) beamforming^{401 402}; and
- the EC has drafted an implementing decision based on CEPT Report 55. However, the adoption of this decision was deferred and the matter has yet to be revisited by the ECs Radio Spectrum Committee.

A 6.50 ComReg outlines below the views expressed by stakeholders and the likely preferences of other stakeholders in light of the above.

MNOs

A 6.51 ComReg notes that, in response to Document 18/60, Three and Vodafone supported the inclusion of the 2.3 GHz Band in the Proposed Award.⁴⁰³ However, Eir did not agree and submitted that consideration of this band should be put on hold until an EC implementing decision on technical harmonisation had been adopted.

A 6.52 In relation to Eir's view, ComReg notes that the lack of an EC harmonisation decision should not be a significant concern given deployments outside of Europe. Indeed, the band already has a significant device presence on the Irish market. ComReg notes that, more latterly, Eir agreed with the inclusion of the 2.3 GHz band in its response to Document 19/59R.

FWA operators

A 6.53 ComReg firstly notes that, in response to Document 18/60 and Document 19/59R, Imagine supported the inclusion of the 2.3 GHz Band in the Proposed Award.

A 6.54 ComReg considers that it is also reasonable to take the view that FWA operators generally are likely to prefer the inclusion of the 2.3 GHz Band because:

⁴⁰¹ <https://www.huawei.com/en/press-events/news/2017/10/Huawei-5G-Oriented-Full-Band-4T4R>

⁴⁰² Award of the 2.3 and 3.4 GHz spectrum bands Annexes to the statement, Ofcom.

⁴⁰³ Vodafone supports the inclusion of the 2.3 GHz Band as it is a sufficiently close substitute to rights of use in the 2.6 GHz Band and also sufficiently complementary to rights of use in the 700 MHz Duplex.

- it would provide 100 MHz of additional suitable LTE-TDD⁴⁰⁴ spectrum, which could be used in addition to 3.6 GHz LTE-TDD and/or 2.6 GHz TDD spectrum;
- the 2.3 GHz Band would be considered an important ‘coverage band’ in the provision of fixed wireless services which is likely to be able to provide additional capacity benefits and end user benefits due to the suitability of the band for beamforming in the future; and
- it would provide for the possibility of carrier aggregation⁴⁰⁵ with the 3.6 GHz Band⁴⁰⁶ and/or 2.6 GHz Band in the future⁴⁰⁷ for MNOs and Fixed Wireless operators.

New Entrants/Other Operators

A 6.55 The assignment of 700 MHz Duplex and 2.6 GHz rights of use under Option 1 would facilitate potential new entry to the mobile telecommunications market by providing a spectrum portfolio suitable for both cost-effective wide-area coverage and capacity in higher density areas. New entrants are also likely to prefer the inclusion of the 2.3 GHz Band because the availability of more substitutable spectrum in the same award increases the opportunity for a new entrant to be assigned rights of use.

A 6.56 Other operators would also likely prefer the inclusion of the 2.3 GHz band. For example, Dense Air (which obtained rights in the 3.6 GHz Award) has used 2.3 GHz Band LTE-TDD small cell and small cell backhaul solutions in conjunction with mobile operators⁴⁰⁸ outside Ireland, and its outdoor 4G LTE-Advanced base station equipment all support the 2.3 GHz Band.⁴⁰⁹ In its submission to Document 19/59R, Dense Air supports the inclusion of the

⁴⁰⁴ Of particular importance has been the development and take up of TD-LTE designed to maximise the use of spectrum in the most efficient way to deliver higher bandwidth services. Derived from fixed wireless protocols and standards, TD-LTE uses the same channel for downloading and uploading data where the spectrum resources are assigned proportionally to reflect and cater for normal broadband usage where the primary requirement is downloading data.

⁴⁰⁵ Carrier aggregation is a key feature of LTE-Advanced (LTE-A) which enables carriers at multiple frequencies to be used together to provide improved data rates for users of 4G networks.

⁴⁰⁶ <https://www.ericsson.com/en/news/2017/4/australian-achievement-nbn-hits-record-in-gigabit-lte>

⁴⁰⁷ More generally, operators are likely to prefer carrier aggregation of bands with similar propagation characteristics. Carrier aggregation of bands with similar propagation characteristics offer better and more consistent quality of service for a given level of coverage because there is less likely to be a coverage mismatch between bands leading to inconsistent quality of service and lower speeds at cell edge, as the impact of one or more of higher frequency bands falls out of coverage. Carrier aggregation of certain bands can be an effective means of overcoming poor speeds for users located at cell edge. The 2.1 GHz Band, 2.3 GHz Band and 2.6 GHz Band are likely to be relevant in this regard.

⁴⁰⁸ <https://www.airspan.com/press-release/afrimax-vodafone-group-deploys-airspans-lte-network-architecture-in-zambia/>

⁴⁰⁹ <https://www.airspan.com/airharmony/>

2.3 GHz band.

A 6.57 In light of the above, industry stakeholders (with the exception of Eir⁴¹⁰) have expressed a preference for, or would likely prefer the inclusion of, the 2.3 GHz band in the Proposed Award.

Option 1 v Option 3 (Inclusion of 2.1 GHz Band with the Primary Bands)

A 6.58 ComReg acknowledges the concerns expressed by some respondents to Document 18/60 on the complexity of including the 2.1 GHz Band in the Proposed Award. These were considered separately in Chapter 5 of Document 19/59R and detailed further in Annex 5 of Document 19/59R. In addition, ComReg acknowledges the complexity concerns raised by respondents to Document 19/59R, and notes that these are considered in Chapter 4. The following analysis focuses upon more general considerations concerning the potential inclusion of the 2.1 GHz Band and should be read in the context of the discussion and specific proposals for the 2.1 GHz Band in Chapter 4.

A 6.59 While stakeholders are likely to support Option 1, some stakeholders (MNOs⁴¹¹, but also FWA operators⁴¹²) may also prefer the inclusion of the 2.1 GHz Band in light of the benefits of additional spectrum described above. In that regard, the 2.1 GHz Band is currently used with the 800 MHz, 900 MHz and 1800 MHz bands to provide mobile services, and could therefore be considered highly complementary to the 700 MHz Duplex, given the similarities between the 700 MHz Duplex and the 800 MHz and 900 MHz bands.

A 6.60 The 2.1 GHz Band is likely to be primarily of interest to existing 2.1 GHz licensees (i.e. MNOs) who therefore form the focus of the discussion below.

MNOs

A 6.61 The 2.1 GHz Band is one of two bands (the other being UMTS in 900 MHz) currently used to provide 3G services. MNOs are likely to continue operating 3G services, before refarming to enable provision of 4G and/or 5G services, and therefore more likely continue to require the band for the provision of 3G services beyond licence expiry (Vodafone's and Three's licences expire in 2022). For example:

⁴¹⁰ In its response to Documents 18/60 but not in the case of its response to Document 19/59R.

⁴¹¹ For example, in their submissions to Document 19/59R, Vodafone and Three support the inclusion of the 2.1 Band, while Eir does not support its inclusion.

⁴¹² For example, Imagine expresses support for the inclusion of the 2.1 GHz Band.

- a) 2G and 3G networks are still required to deliver voice calls across the country;
- b) 3G networks are required to provide data services where 4G services are not currently provided; and
- c) a large number of consumers still have 3G handsets⁴¹³.

A 6.62 However, this requirement is reducing and MNOs are likely to repurpose 2.1 GHz rights to provide 4G and ultimately 5G services over the duration of any new 2.1 GHz Band rights of use. For example:

- in relation to (a), the introduction of VoLTE will reduce the need for 3G networks to provide voice. Vodafone has already implemented VoLTE while Three and Eir have announced their intention to rollout VoLTE.⁴¹⁴;
- in relation to (b), the continued rollout of 4G services by all operators will reduce the reliance on 3G networks for data over time; and
- in relation to (c), while 3G still accounts for around 33% of all subscriptions, this has fallen from nearly 70% in 2014, allowing such customers to be migrated from 3G to 4G.

A 6.63 Further, 3G services are also provided using 900 MHz spectrum, thus providing MNOs with some flexibility in terms of providing 3G connections in a band other than the 2.1 GHz Band. It is likely that 3G spectrum will gradually be repurposed to provide 4G and 5G⁴¹⁵ services as the above developments intensify, with 3G networks likely retiring over the duration of any new 2.1 GHz rights of use. For example, KPN in the Netherlands recently announced its intention to shut down 3G mobile voice/data network services by January 2022⁴¹⁶. Similarly, Telenor previously noted that it would start phasing out 3G networks from 2019.⁴¹⁷ Finally, EE in the UK has refarmed some of its 2.1 GHz spectrum to provide 5 band carrier aggregations in certain areas.⁴¹⁸

A 6.64 However, 3G services will not cease overnight. Rather, the reliance on

⁴¹³ By the end of Q3 2019, 60% of mobile subscribers were categorised as 4G network users, 33.3% were using 3G networks with the remaining 6.9% of subscribers using 2G networks only.

⁴¹⁴ <https://www.irishtimes.com/business/retail-and-services/revenue-slips-10-at-mobile-operator-three-1.3176901>

⁴¹⁵ ECC has tasked ECC PT1 to review the existing ECC Decisions for the 2.1 GHz (ECC Decision (06)01) with a view to adapting the harmonised regulatory framework in these existing frequency bands to account for 5G. ECC PT1 has conducted technical analysis for the 2.1 GHz Band in Draft ECC Report 298. <https://cept.org/ecc/topics/spectrum-for-wireless-broadband-5g>

⁴¹⁶ <https://overons.kpn.nl/nieuws/2018/kpn-gaat-in-2022-stoppen-met-3g-netwerk>

⁴¹⁷ <https://www.teliacompany.com/en/news/news-articles/2g-and-3g-networks-to-retire--norway-first-out/>

⁴¹⁸ <https://rethinkresearch.biz/articles/five-carrier-aggregation-sees-ee-refarming-3g-spectrum-for-lte/>

such networks will reduce over time and across different geographic areas. The inclusion of the 2.1 GHz Band in the Proposed Award would provide operators with additional flexibility to evolve their networks in line with market developments and technology rollouts. For example, additional rights of use beyond expiry would allow repurposing to occur at a pace consistent with market developments (i.e. any operator that did not win additional rights of use would have to significantly reduce the capacity of its 3G networks on expiry).

A 6.65 In light of the above, all MNOs agree that 2.1 GHz rights of use need to be assigned significantly in advance of the expiry of existing licences:

- In its response to Document 18/60 Vodafone submitted that if the issues around complexity can be resolved, it would favour including the 2.1 GHz Band in the Proposed Award. In its response to Document 19/59R, Vodafone supported the inclusion of the 2.1 GHz Band in the Proposed Award;
- In its response to Document 18/60 Eir favoured new 2.1 GHz rights of use, but considered it may be inappropriate for the 2.1 GHz Band to be included in the Proposed Award, particularly if it were based on an auction⁴¹⁹ (see Assignment Option 2B below). In its response to Document 19/59R, Eir did not support the inclusion of the 2.1 GHz Band. Instead Eir favours an alternative assignment approach as discussed under Assignment Option 2B below; and
- In its response to Document 18/60 Three favoured new 2.1 GHz rights that would be assigned through an administrative award process directly to MNOs (see Assignment Option 2B below). In its response to Document 19/59R, Three agreed with many aspects of ComReg's award proposals including the inclusion of the 2.1 GHz Band in the award.

A 6.66 More generally, other stakeholders would likely consider the 2.1 GHz Band as substitutable to the 2.3 GHz Band and 2.6 GHz Bands as it has comparable propagation characteristics and is capable of providing additional capacity (or coverage).

A 6.67 Therefore, with the exception of Eir and subject to concerns regarding award complexity being appropriately addressed (see Chapter 4), industry stakeholders would, on balance, likely prefer that the 2.1 GHz Band be

⁴¹⁹ In that regard, Eir submitted that “near term investment in the band would be deterred if future use of this spectrum is determined by an auction, and an existing operator’s investments to date would be written off if it is driven out of the spectrum”.

included in the Proposed Award.

Option 1 v Option 4 (Inclusion of 1.4 GHz Centre Band with the Primary Bands)

A 6.68 While stakeholders are likely to be in favour of Option 1, some stakeholders may also prefer the inclusion of the 1.4 GHz Centre Band in light of the benefits of additional spectrum described above. ComReg first sets out information on the band and then assesses how that information would likely inform the views stakeholders.

Use of Band

A 6.69 The 1.4 GHz Centre Band is harmonised for the use of SDL which, as the name suggests, aims to provide additional downlink capacity to networks where the downlink resource is constrained due to asymmetry in data flows. As this band has no uplink capabilities, it needs to be used alongside another band/s and as such would be complementary to it.

A 6.70 The 1.4 GHz EC Decision allows the potential for the 1.4 GHz Centre Band to obtain a similar coverage footprint as sub-1 GHz spectrum bands when paired with low frequency spectrum such as the 700 MHz Duplex and 800 MHz⁴²⁰, where this additional capacity would supplement a basic coverage layer provided by spectrum below 1GHz. While specific information on the deployments of SDL networks is limited, it appears initially that the band would be used as a complement to coverage bands such as the 800 MHz band and then at a later point to the 1800 MHz Band, 2.6 GHz Band, 2.1 GHz Band, 900 MHz Band and 3.6 GHz Band⁴²¹. As noted below, devices that have this capability have limited availability in their own right.

Device support of the 1.4 GHz Centre Band

A 6.71 There are currently 118 (November 2019) devices capable of operating in 1.4 GHz Centre Band. These devices are not all currently available in Ireland and some of the devices that are available are expensive, high-end devices (e.g. iPhone XR). While the increase in new devices indicates the development of a device ecosystem, operators are unlikely to be able to

⁴²⁰ This arises because the uplink, which is the limiting factor for coverage, is only carried on the low frequency, while the 1400 MHz frequency is only used for the downlink. The 1.4 GHz EC Decision allows that the in block EIRP can be increased from 68 dBm/5MHz for specific deployments, for example for the aggregated use of spectrum within the 1.4 GHz band and spectrum in lower frequency bands.

⁴²¹ ETSI TS 136 101 release 12 identified that inter band carrier aggregation is supported between the 800 MHz Band (Band 20) and the 1.4 GHz Centre Band (Band 32). In more recent releases other bands that can be carrier aggregated with the 1.4 GHz Centre Band have been added: Release 14: 1800 MHz band (Band 3), 2.6 GHz Band (Band 7), Release 15: 2.1 GHz (Band 1), 900 MHz (Band 8), and 3.6 GHz Band (bands 42 and 43).

effectively use this band to any significant degree until a critical mass of users are able to receive the frequency on their device.

A 6.72 In that regard, ComReg has tested handsets currently available on the Irish market in order to replicate the mobile user experience by measuring the receive performance for data and the antenna sensitivity patterns of mobile handsets. Across various tests conducted between June 2017⁴²² and December 2019⁴²³ 134 smartphones available on the Irish market were tested.

A 6.73 A further analysis of these 137 handsets (134 smartphones) shows the following.

- 125 handsets support the 2.6 GHz Band;
- 89 handsets support the 2.3 GHz Band; and
- 29 handsets support the 1.4 GHz Centre Band.

A 6.74 This assessment shows that both the 2.3 GHz Band and 2.6 GHz Band are well supported across smartphones currently available on the market. In particular, both bands are supported across Samsung and Apple devices which account for around 72% of the smartphone market.⁴²⁴ Devices that do not support these bands tend to be older generation 'pay as you go' devices that are typically associated with low data users. However, it is clear that the availability of handsets which support the 1.4 GHz Centre Band is much lower.

Support for 1.4 GHz Centre Band on existing base stations

A 6.75 ComReg understands from an assessment of the apparatus specified in MNO licences that the base station equipment (base transceiver station and antennas) are primarily multi-band and cover existing bands, such as the 800 MHz, 900 MHz, 1800 MHz, and 2.1 GHz bands, but also the 700 MHz Duplex, 2.6 GHz Band, and to a lesser extent the 2.3 GHz Band. However, existing base station equipment does not appear to cover the 1.4 GHz Centre Band. If so, an operator assigned 1.4 GHz Centre Band rights would therefore likely need to install additional/new specialised antenna equipment in order to use such rights.⁴²⁵

⁴²² See Document 18/05, Document 18/78, Document 18/82, Document 18/109 and Document 19/67.

⁴²³ See Document 19/110, published 11 December 2019

⁴²⁴ Mobile Consumer Experience, Document 19/101, slide 43.

⁴²⁵ <https://www.kathrein.com/en/solutions/mobile-communication/products/antennas-accessories/outdoor-antennas/>

Future harmonisation of the band

- A 6.76 While the 1.4 GHz Centre Band is harmonised for use as SDL in Europe, as outlined in Chapter 3 of Document 19/59R, the 1.4 GHz Band (i.e. the Centre Band and the Extension Bands) is also standardised on both a TDD and FDD basis for both LTE and 5G standards⁴²⁶. Further, and while noting that this is in the context of the 2.6 GHz Band, CEPT, when issuing a consultation on its draft revision of ECC Decision (05)05 for the 2.6 GHz Band, requested information⁴²⁷ on the implementation of “Alternative 2: Supplemental Downlink blocks” in national authorisations. This was in order to determine if the SDL alternative should be kept in future revisions of ECC Decision (05)05. Noting the above, and the limited deployment of SDL networks to date (see Chapter 3 of Document 19/59R), it is possible that the harmonisation status of this band may emerge as a topic for consideration.
- A 6.77 ComReg outlines below the views expressed by stakeholders and the likely preferences of other stakeholders in light of the above.

MNOs

- A 6.78 First, and as identified in Chapter 3 of Document 19/59R, Eir and Vodafone disagreed with ComReg’s proposal in Document 18/60 to exclude the 1.4 GHz Centre Band, whereas Three agreed with the proposed exclusion of this band. The reasons informing these views, and ComReg’s assessment of same, were set out in Chapter 3 of Document 19/59R and are not repeated here. In their responses to Document 19/59R, neither Vodafone nor Three argue for the inclusion of the 1.4 GHz Band in the Proposed Award while Eir was silent on this matter in its response to Document 19/59R.
- A 6.79 Second, while stakeholders are generally likely to prefer additional substitutable spectrum in the same award process, there is some uncertainty on future plans for the band and additional uncertainty as to whether any rights awarded would be used efficiently in the years following the Proposed Award.
- A 6.80 In relation to the latter issue, and as noted above, existing base station equipment would not appear to cater for the 1.4 GHz Band. If so, the process of upgrading sites to include 1.4 GHz Centre Band capability is unlikely to happen prior to the rollout of other Candidate Bands as operators would presumably prefer to capitalise on the more ready deployment of the

⁴²⁶ <http://www.3gpp.org/>

⁴²⁷ See cover letter to draft revision of ECC/DEC/(05)05

other Candidate Bands. In its Mobile Termination Rate consultations and draft model, ComReg observed that an asset life of 8 years is used for base station equipment.⁴²⁸ Therefore, depending on the asset life of existing base station equipment it could be a number of years before operators would be incentivised to upgrade such assets to take make use of 1.4 GHz Centre Band rights.

- A 6.81 Further, some operators may wish to defer assignment of 1.4 GHz Centre Band rights of use if they do not have an immediate need for same as this would allow them to observe developments and make preparations for any future award. This would allow operators to deploy using rights of use assigned in the other bands, which are largely compatible⁴²⁹ with their existing networks (i.e. no significant equipment upgrades are required), and then assess the need for 1.4 GHz Centre Band spectrum. In the meantime, in order to increase capacity on its network, an MNO would likely use the 2.3 GHz and 2.6 GHz Bands which can be of immediate use on a significant portion of existing base stations.
- A 6.82 Finally, even if MNOs upgraded their networks to support the 1.4 GHz Centre Band, it is only supported on certain handsets, which have only recently become available and are generally high-end expensive handsets that typically can only be used with the 800 MHz Band. Further, while consumer handsets typically tend to be around 2-3 years old, around 10% are over 5 years old.⁴³⁰ Assuming all new phones on the market would have 1.4 GHz Centre Band capability, it will likely take at least 3 years of handset churn until a sufficient number of subscribers have compatible devices and over 5 years until all areas, particularly rural areas, are capable of benefiting from the band to any significant degree. It would take longer again before all consumer handsets compatible with the 1.4 GHz Band could operate alongside the full range of spectrum holdings (i.e. bands other than 800 MHz). In that regard, Three and Vodafone both agree that it is preferable to wait until more clarity is available regarding take-up and standardisation of the 1.4 GHz Band.
- A 6.83 Alternatively, MNOs may prefer to include the 1.4 GHz Centre Band and/or other SDL spectrum in the Proposed Award. At least 40 MHz of rights of use (1.4 GHz Centre Band) is available for assignment.⁴³¹ Stakeholders may prefer to be assigned rights of use as part of this award in order to guard against capacity constraints that may arise in the future or in the event

⁴²⁸ Decision Price Control Obligations for Fixed and Mobile Call Termination Rates, Document 19/48.

⁴²⁹ Depending on the particular operator and base station, existing equipment may not be compatible with 2.3 GHz in certain areas.

⁴³⁰ 2019 Mobile Consumer Experience Survey, Document 19/101, slide 45.

⁴³¹ <https://gsacom.com/gambod/> report as per November 2019 that there are 118 devices in band 32 increasing from 83 in May 2018

of significant delays in refarming the 1.4 GHz Extension Bands. For example, Eir in its response to Document 18/60 indicated that it would prefer the inclusion of SDL spectrum more generally by including the 1.4 GHz Centre Band and the 700 MHz Duplex Gap.

FWA operators

- A 6.84 Fixed Wireless operators are likely to be indifferent about the inclusion of the 1.4 GHz Centre Band. For example, in its response to Document 18/60, Imagine agreed with ComReg's proposal not to include the 1.4 GHz Centre Band in the Proposed Award.
- A 6.85 While the 1.4 GHz Centre Band has recently been added by 3GPP to be carrier aggregated with the 3.6 GHz band, it is likely to take time before fixed wireless equipment becomes available. Given the current rollout plans of existing Fixed Wireless Providers, the 1.4 GHz Centre Band is unlikely to be of any real benefit. It does not offer any uplink possibilities which is likely to be more important for FWA operators given the higher upload requirement from fixed broadband services.
- A 6.86 Further, the available capacity (40 MHz) is relatively small and any rights of use assigned to a FWA operators would in turn likely be small (if a band-specific spectrum cap were applied). While the 1.4 GHz Centre Band has the potential to offer a similar coverage footprint to a sub-1 GHz deployment⁴³² this is currently only possible when paired with low frequency spectrum, such as the 700 or 800 MHz band, which may be less relevant to FWA operators given the typical network configuration for fixed wireless as described above.⁴³³ Pairing with 3.6 GHz would provide additional capacity within the coverage area of the 3.6 GHz spectrum but not beyond this.

Other Operators/New entrants

- A 6.87 The 1.4 GHz Centre Band would likely be a low priority for potential new entrants. While a new entrant would be able to rollout a new network and provision for 1.4 GHz Centre Band from the outset, consumer handsets would still lag significantly behind and the earliest of those handsets are only compatible when the 1.4 GHz Centre Band is used in conjunction with the 800 MHz band (which is not available to a new entrant). A potential new

⁴³² This arises because the uplink, which is the limiting factor for coverage, is only carried on the low frequency, while the 1400 MHz frequency is only used for the downlink. The 1.4 GHz EC Decision allows that the in block EIRP can be increased from 68 dBm/5MHz for specific deployments, for example for the aggregated use of spectrum within the 1.4 GHz band and spectrum in lower frequency bands.

⁴³³ While not implausible, DotEcon are of the view that there is unlikely to be demand from fixed wireless operators for the 700 MHz band as the limited amount of contiguous spectrum in the sub-1 GHz bands makes it less attractive for providing services that require higher capacity links.

entrant's first priority would be to obtain a mixture of coverage and capacity / performance bands, noting that the 1.4 GHz Centre Band can only be used with existing rights of use.

A 6.88 Other operators such as Dense Air are unlikely to be interested in the 1.4 GHz Centre Band. In response to Document 18/60, Dense Air noted that it is not focused on "macro" bands such as the 700 MHz and the 1.4 GHz Centre Band. For example, the 1.4 GHz Centre Band is not operational on its outdoor⁴³⁴ or Pico⁴³⁵ base station equipment. However, Dense Air did indicate that it preferred the inclusion of the 1.4 GHz Band in the Proposed Award.

A 6.89 In light of the responses received to Document 18/60 and Document 19/59R, stakeholders are likely to have contrasting views on the inclusion of the 1.4 GHz Centre Band. Notwithstanding, the inclusion or otherwise would not appear to significantly benefit or compromise any individual operators network plans. For example, while Vodafone in its response to Document 18/60 would prefer to include 1.4 GHz Centre Band in this award, it noted that the band is not a high priority and its value is less than other bands.

Impact on Competition

A 6.90 Before assessing each of the options under this heading, ComReg sets out some relevant information below on the interaction between spectrum awards and competition.

A 6.91 A key objective in designing and carrying out this award process is to encourage the efficient use and ensure the effective management of the radio frequency spectrum in order to promote competition and maximise the benefits for consumers in terms of price, choice and quality. In that regard, ComReg briefly explains how the release of additional spectrum rights in the same award typically encourages efficient assignment and use of spectrum which, in turn, should promote competition on the relevant downstream markets to the benefit of consumers. The impact on consumers is assessed separately after this section.

A 6.92 There are important competition and efficiency reasons for including substitutable and complementary spectrum in the same award process. Where demand for spectrum in different bands is interdependent (substitutable and/or complementary), a joint award for such spectrum reduces the risk of an award participant being assigned rights of use in

⁴³⁴ <https://www.airspan.com/airharmony/>.

⁴³⁵ <https://www.airspan.com/wp-content/uploads/2017/02/AirSynergy-Product-Spec-Sheet.pdf>

some but not all of its preferred bands, and provides an opportunity for different types of award participants (with potentially different intended uses and technologies), including potential new entrants, to participate in an award.

- A 6.93 In particular, it increases the ability of award participants to express a full suite of preferences, thereby enhancing the efficiency of the award outcome which, in turn, has a positive impact on competition. If spectrum in different bands are substitutable or complementary, the demand for spectrum in a particular band (and the value placed on this spectrum) may be affected by the availability and price of spectrum in other bands. For example, in an open award process, bidders can observe the relative prices of spectrum in different bands and change valuations and consequent demand for spectrum across those bands in response to these emerging relative prices. Even a sealed bid award can provide for an efficient outcome if bidders express their preferences over a sufficiently large number of packages so that all combinations of lots that might potentially be relevant in the efficient assignment are included.
- A 6.94 The ability of operators to compete for different packages of spectrum promotes competition in downstream markets as they are likely to have different requirements across the various bands and would be able to differentiate themselves from rivals downstream, to a greater or lesser extent, depending on the rights of use that are ultimately assigned. As a result, depending on whether or not additional bands are included may affect the efficiency of the assignment across bidders. Providing a mix of interdependent bands in the same award also increases competition within the award as bidders with similar use cases are likely to compete for the same spectrum bands across different quantities.
- A 6.95 An appropriate mix of spectrum across different bands provides flexibility to adapt to changes in, among other things, technologies, demand from end-users and market developments. As noted by DotEcon in Document 19/59a, access to additional spectrum should tend to reduce the long-run marginal costs to MNOs of expanding network capacity, which in turn should have pro-competitive benefits that are passed on to consumers.⁴³⁶ This has clear advantages in terms of promoting spectrum use and related services, and in turn intensifying competition in downstream markets. It also provides a good opportunity to acquire significant bandwidth of contiguous spectrum and therefore promote entry and the development of new services for consumers. This benefit is particularly pronounced given the growth in consumer demand for wireless data services and the consequent increased

⁴³⁶ DotEcon Report, Document 19/59a, p 38.

demand for wireless broadband spectrum.

- A 6.96 In contrast, where substitutable or complementary spectrum is awarded in separate and consecutive award processes, operators' valuations of spectrum in different bands would necessarily be based on the expected price of substitutable and complementary spectrum to be awarded in subsequent processes, rather than the actual valuation (if assigned in the same award). However, there is a real risk that bidders would be appreciably wide of the mark in terms of their expected valuations as they would be based on the expected price and availability of substitutable and complementary spectrum to be awarded in the future. If expectations with regard to future prices or availability are incorrect then a sequential process may lead to an inefficient assignment of spectrum.
- A 6.97 This is likely to have impacts on downstream competition if a bidder's expectations about price and consequently the type and quantum spectrum it would receive in a future award are incorrect. If a bidder's ability to compete in downstream markets is dependent on spectrum assigned across different bands, which are awarded sequentially, then there is a risk that bidders who would have been able to deliver a particular set of services for a given mix of spectrum cannot because its views on what it would have been assigned across different awards was incorrect.
- A 6.98 The appropriate release of harmonised spectrum bands in the past has proven to be successful in promoting competition and facilitating the delivery of services to end-users. It also lowers the risk of artificial scarcity in an award where substitutable and complementary spectrum bands are available for release. As there is demand to use this spectrum for the provision of more advanced WBB services, leaving it to remain fallow for a period of time without clear reason would, ostensibly at least, not be an efficient use of that spectrum and would not therefore promote competition in the WBB sector.
- A 6.99 Finally, the joint award of interdependent spectrum would increase the potential for new entry on account of the mix of spectrum above and below 1GHz and the increased supply of contestable spectrum rights.

Option 1 v Option 2 (Inclusion of 2.3 GHz Band with the Primary Bands)

- A 6.100 In light of the above discussion, ComReg is of the preliminary view that the inclusion of 2.3 GHz Band would promote competition both within the Proposed Award and in downstream broadband markets. In summary:
- all frequencies are available for release at the time of the Proposed Award;

- the band is likely to be of interest to a wide range of interested parties (i.e. MNOs, FWA operators and other operators):
 - it has similar propagation characteristics to the 2.6 GHz Band and other Candidate bands and is harmonised for WBB or MFCN services;
 - it provides TDD spectrum that can be used to account for asymmetric traffic flows;
 - there is a large existing ecosystem of handsets and existing network equipment can accommodate 2.3 GHz Band to a greater or less extent; and
 - additional TDD rights are likely to be of interest to FWA operators;
- its inclusion would provide more contestable spectrum for incumbents and new entrants and would provide increased opportunities for bidders to compete and switch between various spectrum bands, promoting competition during the Proposed Award; and
- its inclusion would encourage new entry and promote competition between operators acquiring a portfolio of spectrum.

A 6.101 Accordingly, ComReg is of the preliminary view that the inclusion of the 2.3 GHz Band in the Proposed Award would have a positive impact on competition. Further, this preliminary view would not change by virtue of whether any of the other Candidate Bands were also included in the Proposed Award.

Option 1 v Option 3 (Inclusion of 2.1 GHz Band with the Primary Bands)

A 6.102 In general terms, the inclusion of the 2.1 GHz band would provide similar benefits to competition as the inclusion of the 2.3 GHz Band as described above.

A 6.103 The inclusion of the 2.1 GHz Band would also allow for the timely determination of the future of this band beyond the expiry of existing licences. As noted above, the 2.1 GHz Band is currently used to provide 3G services across the State. Assuming that future rights of use in this band are assigned by means of an auction process rather than an administrative procedure (see the 'Assignment Process' RIA below), if either Vodafone or Three were assigned no or reduced 2.1 GHz rights of use in an award process carried out in circa 2020, they would have around two years to address any transition activities arising from same, and to consider network upgrades to 4G more generally.

- A 6.104 Alternatively, new rights in the 2.1 GHz Band could be assigned in a separate award process following the Proposed Award (the former of which would also require a detailed consultation process in advance of this separate award process⁴³⁷). In this scenario, ComReg firstly observes that there presumably would remain the potential for Vodafone and/or Three to be assigned no or reduced 2.1 GHz rights. However, as the consultation process for this separate award may not conclude until close to the expiry of existing licences in 2022, there would likely be less time before licence expiry for measures to be undertaken by an existing licensee to adjust their network to the outcome of this separate award (including obtaining no spectrum or less spectrum than presently held).
- A 6.105 In contrast, the inclusion of the 2.1 GHz Band in the Proposed Award would also allow MNOs to better plan the rollout of LTE 2100 by providing earlier certainty around what 2.1 GHz rights they would have in the long term. In that context, any rollout of LTE 2100 prior to 2022 (Three and Vodafone) without visibility of their long term 2.1 GHz holdings may involve significant investment uncertainty and could result in inefficient investments.
- A 6.106 In that regard, the inclusion of 2.1 GHz Band would promote efficient investment and innovation in new and enhanced infrastructures by providing MNOs with earlier visibility around what 2.1 GHz rights they will have in the long term.
- A 6.107 Accordingly, ComReg is of the preliminary view that the inclusion of the 2.1 GHz Band in the Proposed Award would, on balance, have a positive impact on competition. Further, this preliminary view would not change by virtue of whether any of the other Candidate Bands were also included in the Proposed Award.

Option 1 v Option 4 (Inclusion of 1.4 GHz Centre Band with the Primary Bands)

- A 6.108 The inclusion of the 1.4 GHz Centre Band would, ostensibly at least, provide similar benefits to competition as the inclusion of the 2.3 GHz Band as described above. However, there are a number of issues that separate the 1.4 GHz Centre Band from other Candidate Bands in terms of suitability for inclusion in the Proposed Award. These have already been set out in detail earlier, but are summarised below for convenience.
- A 6.109 For example, it is questionable whether the 1.4 GHz Centre Band is suitable for release at this time. In particular, there is uncertainty over a number of issues that could result in the inefficient assignment and use of the band,

⁴³⁷ ComReg has statutory obligations to appropriately consult on any such award process which would mean that any such award process would unlikely take place significantly in advance of current licence expiry dates.

thereby reducing competition and benefits to consumers, including:

- it is possible the current harmonisation status of the 1.4 GHz Centre Band for SDL in Europe may be reviewed and modified⁴³⁸, noting the limited deployments of SDL in the 1.4 GHz Centre Band to date, and the 3GPP standardisation of the 1.4 GHz Band (i.e. Centre Band and Extension Bands) which also provides for both a FDD and TDD band plan;
- It is unlikely that operators would realistically use the 1.4 GHz Centre Band to any great extent in the years following the Proposed Award⁴³⁹. In order for an operator to effectively use additional spectrum it requires both base stations and end user devices to transmit and receive the relevant frequencies:
 - in the period following 2020 there is likely to be limited base station equipment or end user devices to facilitate the efficient use of the 1.4 GHz Centre Band;
 - operators are likely to focus on the deployment of other spectrum bands first, noting that the other Candidate Bands are widely deployed globally by networks and are deployed across a large number of handsets;
- In the absence of sufficient demand for this band, one could artificially stimulate demand by making it available at a relatively low minimum price. However, this could result in the premature award of spectrum rights which may inefficiently displace or restrict valuable future uses.

A 6.110 Conversely, there would appear to be a number of reasons for delaying the release of this band. For example:

- greater certainty about the long term band plan would likely be available in the years following the Proposed Award;
- operators should be in a better position to use the 1.4 GHz Centre Band to deliver services as:

⁴³⁸ While noting that this is in the context of the 2.6 GHz Band, CEPT, when issuing a consultation on its draft revision of ECC Decision (05)05 for the 2.6 GHz Band, requested information on the implementation of “Alternative 2: Supplemental Downlink blocks” in national authorisations. This was in order to determine if the SDL alternative should be kept in future revisions of ECC Decision (05)05.

⁴³⁹ Further, ComReg understands that current antenna systems are not designed / optimised to operate in the 1.4 GHz Band. As such, dedicated equipment may be needed.

- 1.4 GHz Centre Band capability can be added to existing networks in line with the end of the asset life of existing equipment; and
- users device will have greater 1.4 GHz Centre Band capability as consumers replace older devices over time;
- the proposed inclusion of the 2.3 GHz Band (100 MHz) and the 2.6 GHz Band (190 MHz) should be sufficient to satisfy any capacity constraints⁴⁴⁰ that may arise in the medium term, and the absence of the 1.4 GHz Centre Band would be unlikely to create any artificial scarcity concerns that could compromise competition in the Proposed Award;
- it would be difficult to determine appropriate rollout obligations to ensure the efficient use of the spectrum given uncertainty about when user and base station equipment is likely to be rolled out to sufficient levels.

A 6.111 In light of the above, ComReg is of the view that, while the 1.4 GHz Centre Band is available for use and a device ecosystem is beginning to develop, effective management of the radio frequency spectrum in order to promote competition would be better facilitated by not including the 1.4 GHz Centre Band in the Proposed Award. Instead, competition would be better served by including the band in a separate and subsequent award process.

Impact on Consumers

A 6.112 It can be assumed that what is good for competition is, in general, good for consumers because increased competition between wireless service providers brings benefits to customers in terms of price, choice and quality of services.

A 6.113 As outlined previously, consumer demand for WBB has grown significantly in recent years and is expected to continue growing over the coming years. The spectrum bands under consideration in this draft RIA are all suitable for the provision of such services which should increase consumer welfare. ComReg notes that each of the options assessed below involve additional spectrum being made available for assignment to existing operators or potential new entrants. In that regard, ComReg sets out below the main reasons why consumers would likely benefit from the assignment of

⁴⁴⁰ Noting also that the assignment of the 700 MHz Duplex, while particularly suited for rural deployments, would provide additional capacity wherever it's deployed in addition to the other bands already providing capacity.

additional spectrum rights of use.⁴⁴¹

Benefits of additional spectrum to consumers

A 6.114 The avoided costs from using additional spectrum instead of rolling out additional base stations to meet rising demand for mobile broadband rather than investing in additional base stations should lead to lower prices. In competitive markets, it is expected that network cost savings would partly be passed onto consumers in the form of improved and/or lower cost services.

A 6.115 The cost of improving network performance (e.g. increasing average user speeds) without new spectrum may be so high that it is unprofitable to attempt to do so. Hence, the speeds and quality of service that an operator offers in practice are likely to be partly determined by how much spectrum rights of use it acquires. The deployment of additional spectrum enables considerably higher user data rates and supports a greater number of users, all of which will substantially enhance the user experience. This includes faster download speeds and the ability to support a greater number and variety of users. These benefits are consistent across all options below that assign additional rights of use.

Option 1 v Option 2 (Inclusion of 2.3 GHz Band with the Primary Bands)

A 6.116 As noted above, the inclusion of the 2.3 GHz Band in the Proposed Award would, on balance, have a positive impact on competition, which in turn should benefit consumers. There are other reasons why the addition of this band should benefit consumers. For example, the benefits to consumers in terms of higher quality and speeds as described above.

A 6.117 In addition to the benefits of additional capacity for MNOs, the 2.3 GHz Band provides a large amount of contiguous spectrum suitable for providing fixed wireless services across a large area. For example, like the 3.6 GHz band, the 2.3 GHz Band might be viewed as a 'performance' band for fixed wireless services, increasing the availability of suitable spectrum for fixed wireless operators and increasing the prospects of new entry.

A 6.118 The band also provides increased opportunity for operators to manage asymmetric data flows in the future. High quality and high resolution audio-visual services are important drivers for increased downlink data rates, whereas user generated content, including sharing of social media and/or video calling is the main driver for increased uplink data rates.

⁴⁴¹ Subject to appropriate competition caps.

A 6.119 Smartphones are increasingly becoming 'creation' devices that upload or share content with other users. Features such as high quality cameras⁴⁴² for video and photos along with sophisticated software and hardware capabilities allow digital processing and advanced online gameplay⁴⁴³ all of which use uplink capacity. Similarly, users are uploading information from mobile devices to cloud services and sharing photos via social networks making upload capacity increasingly important on a per GB basis even if the downlink/uplink ratio is increasing. Therefore, consumers are likely to favour options which provide operators with flexibility in terms of network configuration, where it is needed, as this would likely lead to improved performance of applications/services which require additional uplink capacity.

A 6.120 In light of the above, ComReg is of the preliminary view that including the 2.3 GHz Band in the Proposed Award would, on balance, be more beneficial for consumers.

Option 1 v Option 3 (Inclusion of 2.1 GHz Band with the Primary Bands)

A 6.121 As noted above, the inclusion of the 2.1 GHz Band in the Proposed Award should, on balance, have a positive impact on competition, which in turn should benefit consumers. Importantly, as noted earlier, the inclusion of the 2.1 GHz Band in the Proposed Award would, compared to a separate and subsequent award, provide MNOs with earlier certainty about future 2.1 GHz holdings and thus a longer period to reorganise their 3G networks in a timely manner prior to the expiry of existing rights of use. This would facilitate operators liberalising 2.1 GHz rights of use earlier than would otherwise be the case giving MNOs the choice to deploy more advanced technologies to cater to changing consumer demands.

A 6.122 In light of the above, ComReg is of the preliminary view that including the 2.1 GHz Band in the Proposed Award would, on balance, more beneficial for consumers.

Option 1 v Option 4 (Inclusion of 1.4 GHz Centre Band)

A 6.123 The inclusion of the relatively small 1.4 GHz band in the Proposed Award

⁴⁴² For example, triple-camera systems which enable ultra wide footage are becoming a feature of smartphones ".Apple recently released the iPhone 11 which "provides pro-level camera experience" with three scales: ultra-wide, wide and standard, which can be chosen while using Apple's Camera app.

⁴⁴³ The data requirements for games can often be significant as uplink and downlink will have to be synced with unnoticeable latency to ensure appropriate performance. The uplink requirements are likely to increase as games become cloud based in the future. For example, Microsoft are developing a game streaming network to unlock console gaming on any device and the service will work across Xbox, PCs, or phones.

<http://telecoms.com/490215/microsofts-cloud-gaming-ambitions-set-to-further-test-network-capacity/>

is unlikely to have much if any impact on stakeholders or competition. Conversely, there appear to be good reasons for delaying the release of this band in terms of encouraging the efficient use and ensuring the effective management of the radio frequency spectrum. On that basis, ComReg is of the preliminary view that excluding the 1.4 GHz Centre Band from the Proposed Award and instead assigning it in a separate future award process is, on balance, more beneficial for consumers.

Preferred Option - 'Spectrum for Award' RIA: (Step 5)

A 6.124 In light of the above, ComReg is of the preliminary view that including the 700 MHz Duplex, 2.6 GHz Band, 2.3 GHz Band and 2.1 GHz Band in the Proposed Award (i.e. Options 2 and 3 together) ("Award Bands") is the preferred option in terms of the impact on stakeholders, competition and consumers.

A6.5 The 'Assignment Process' RIA

A 6.125 As noted earlier, Step 1 of the RIA (Policy Issues and Objectives) is common to both the 'Spectrum for Award' RIA and the 'Assignment Process' RIA.

A 6.126 Before setting out the specific options under review in this draft RIA, ComReg first sets out some background information regarding different ways in which spectrum rights can be assigned and some key characteristics of these assignment mechanisms. ComReg does not favour any one process for assigning new rights of use of spectrum as a matter of principle; it decides the most appropriate process in each individual case. In this regard, there are two main ways by which to award new rights of use.

1. **Administrative Assignment:** the regulator determines who obtains spectrum, how much they obtain and the location of the frequencies within the band, and the price paid; or
2. **Competitive market mechanism:** the interaction of bidders during the award determines who wins the spectrum and the price paid, subject to objective and transparent rules set *ex ante* by the regulator (e.g. an auction).

A 6.127 Each process will typically have its particular advantages and disadvantages and one process may, on balance, be found to be the most suitable in light of the particular factual matrix, including the characteristics of the spectrum to be assigned, the types of rights of use to be awarded and the anticipated demand for the spectrum.

Background Information

A 6.128 An administrative assignment can take many forms depending on the specific issues that need to be addressed. For example, it could:

- involve the administrative grant of spectrum to certain operators (such as incumbents), the reservation of spectrum for particular groups (such as new entrants) or the reservation of spectrum for other purposes;
- involve a comparative award (or “beauty contest”) if there are particular objectives in mind;
- take the form of an extension or renewal of an existing licence or an administrative assignment of spectrum to particular operators, for a particular period of time; or
- involve simple granting of licences where uses are not incompatible, for instance in relation to point to point links.

A 6.129 Administrative approaches are likely to be most beneficial where there is no excess demand for spectrum. Administrative awards, however, rely on the regulator making decisions, with the intention of promoting the efficient use of spectrum, where such decisions could be made with significant information asymmetries. This approach raises concerns in particular when dealing with valuable spectrum rights of use for which there is likely to be excess demand that regulators may pick the incorrect technologies, services or licensees.

A 6.130 In contract, spectrum auctions are designed to incentivise bidders to express their willingness to pay for spectrum rights, and aims to assign the available rights of use of spectrum to the bidders who value it the most. An appropriately designed auction extracts information regarding bidders’ willingness to pay for the rights of use of spectrum thereby enabling an assignment to the bidders who value the spectrum most.

A 6.131 By ensuring that those bidders who value the spectrum the most obtain the rights being offered, auctions should result in an efficient outcome in terms of assignment.⁴⁴⁴ Using an auction to assign spectrum rights of use for which demand is likely to exceed supply mitigates the risk of the regulator making incorrect decisions, as a result of not having access to all relevant information, which could have long standing negative effects on the relevant

⁴⁴⁴ Each bidder’s valuation of spectrum should be dependent on the value it believes it can derive from the use of the spectrum and is therefore a good proxy for the overall economic value likely to be generated from such use.

market/s. Moreover, auctions provide a transparent and non-discriminatory mechanism to allocate rights of use of spectrum relatively quickly and this mitigates the risk of prolonged challenges to the outcome of the allocation process.

A 6.132 Auction formats however are silent on the type of services that should be provided by the winning bidders. Where spectrum for award that is currently being used to provide certain existing services is assigned to a different operator who utilises the spectrum to provide unrelated services, there is a risk that consumers reliant on existing services would be left unserved. Where this occurs additional measures to protect consumers may be necessary (e.g. transition measures).

A 6.133 ComReg has previously expressed views on the assignment of spectrum rights by auction or administrative award.⁴⁴⁵ As noted in section 4.4.2 of Document 19/59R, ComReg has identified a number of outcomes⁴⁴⁶ that a regulator would need to determine in any spectrum award *irrespective of the assignment format adopted*:

1. Which electronic communications networks/services, using which technologies, are going to be the ones most likely to provide the greatest end-consumer benefits over the proposed duration of the rights being awarded?
2. Which of all the interested providers of the ECN/ECS (and using potentially different technologies) identified in (1) are going to be the ones most likely to provide the greatest end-consumer benefits over the duration of the rights being awarded and should, therefore, be issued said rights?
3. Determination of the quantum of spectrum rights in each of the proposed bands that should be assigned to each provider identified in (2).
4. Determination of which part of the band those spectrum rights identified in (3) should be located.

A 6.134 The award outcomes are less relevant where demand is unlikely to exceed supply over the duration of the rights being awarded. Administrative assignments are likely to be appropriate in such circumstances as each of the award outcomes can be established through the demands of interested

⁴⁴⁵ Chapter 3, Document 14/101, ComReg (2014) 'Spectrum Award – 2.6GHz Band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz Band; Chapter 3 of Document 15/70, ComReg (2015) 'Consultation on Proposed 3.6 GHz Band Spectrum Award'; and Chapter 3 of Document 15/140, ComReg (2015) 'Response to consultation and draft decision on proposed 3.6 GHz band spectrum award' (page 32)

⁴⁴⁶ Readers are referred to Section 3.3 of Document 15/140 for a detailed discussion on each of the award outcomes.

parties. In this situation, there is less risk of the regulator assigning the spectrum in a manner which would result in its inefficient use, since all competing requirements can be provided for.

A 6.135 However, where demand is potentially greater than supply, ComReg, in an administrative assignment process, would have to make an administrative determination on each of the award outcomes listed above. ComReg is of the preliminary view that demand for the new rights of use in one or more of the proposed bands is likely to exceed supply in light of the discussion in the draft Spectrum for Award RIA (under the heading 'Demand for Spectrum').

Identifying the options

A 6.136 In light of the above, there are two broad non-mutually exclusive regulatory options available to ComReg in terms of assigning rights of use in the 700 MHz Duplex, 2.6 GHz Band, 2.3 GHz Band and the 2.1 GHz Band:

- assign some or all spectrum rights of use by administrative assignment; and/or
- assign some or all spectrum rights by way of auction.

A 6.137 The responses to Document 18/60 and the subsequent Nera Report (commissioned by Three), and the responses to Document 19/59R express the view that it is appropriate to consider both an auction and/or an administrative assignment as an assignment process for the Proposed Award. Further, two distinct categories of administrative assignment have been suggested with a further iteration provided by Eir in response to Document 19/59R.

A 6.138 **First**, Nera submits in relation to the 2.1 GHz Band that, in its view, there is a strong case for an administrative award of 2.1 GHz rights directly to MNOs with 2x20 MHz assigned directly to each operator. ComReg considers this proposal under Assignment Option 2B below. Similarly, Eir suggests that 2x15 MHz of spectrum in the 2.1 GHz Band be directly assigned to each of the three MNOs with the remainder assigned by way of auction.

A 6.139 **Second**, Eir submits in its response to Document 18/60 that, in its view, it is time to move away from CCA formats to another format reflective of what it considers a more mature market. In that regard, it notes the experience in France where the regulator agreed to extend spectrum licences (*"giving up future income"*) to MNOs for ten years in return for firm commitments to

enhance 4G coverage⁴⁴⁷. ComReg notes a number of pertinent points in relation to the French award that could inform a potential option in this draft RIA:

- the award procedure was a beauty contest open to any interested market player. The procedure was the result of an agreement between the French government and the mobile operators in January 2018^{448 449};
- coverage obligations applied to licences that were due to expire in the period up to 2021 and 2024⁴⁵⁰:
 - 900 MHz (2x30 MHz)⁴⁵¹ – obligation to increase density of 900 MHz sites to enhance availability of voice and SMS services;
 - 1800 MHz (2x65 MHz)⁴⁵² - coverage of main roads and regional railway connections and applicants could include additional commitments for commuting trains; and
 - 2 GHz bands (2x90 MHz)⁴⁵³ - commitments to improve indoor mobile coverage and/or to provide fixed broadband services in remote areas;
- Only the four existing MNOs applied for licences.

A 6.140 ComReg notes that the only rights of use available for reassignment in Ireland are 2.1 GHz rights of use. However, it is unlikely that Eir is referring to this band with respect to improving 4G coverage. Alternatively, it would appear that Eir may be suggesting that rights of use to the 700 MHz Duplex should be assigned to the MNOs in return for certain unspecified coverage obligations.⁴⁵⁴ ComReg observes that that proposed obligations would

⁴⁴⁷ The main obligations for the new licensees in the French award are to improve and increase access to mobile networks: to cover areas with no or very poor coverage and to enable access to mobile broadband everywhere. The tender document also included specific obligations to improve mobile connectivity on main roads, from regional railway connections and indoor. Applicants could also propose additional coverage commitments in the 1800 MHz and 2 GHz bands. Source: Cullen International.

⁴⁴⁸ <https://www.cullen-international.com/product/documents/FLTEFR20180005>

⁴⁴⁹ If more than four applicants (number of MNOs) had qualified for a band, the selection would have been based on:

- a single round sealed bid auction for the 900 MHz band;
- commitments for better coverage inside trains for the 1800 MHz band; and
- commitments for better indoor coverage for the 2 GHz band.

⁴⁵⁰ <https://www.cullen-international.com/product/documents/FLTEFR20180005>

⁴⁵¹ Free Mobile has 2x10 MHz rights of use until 2030.

⁴⁵² Free Mobile has 2x15 MHz rights of use until 2030.

⁴⁵³ Orange, SFR and Free all have 2x10 MHz rights of use expiring in 2030.

⁴⁵⁴ DotEcon (Document 18/103d) distinguish between precautionary and interventionist coverage obligations:

appear to be of an 'Interventionist' nature and considers this proposal under Assignment Option 2A below.

A 6.141 In light of the above, ComReg considers that three regulatory options are available to it

- **Assignment Option 1:** Assignment of all available spectrum using a competitive, open, transparent auction format; or
- **Assignment Option 2:** Assignment of some or all available spectrum band by administrative assignment. In particular:
 - **Assignment Option 2A:** Administrative assignment of 2x10 MHz of 700 MHz Duplex rights of use in return for interventionist coverage obligations.
 - **Assignment Option 2B:** Administrative assignment of 2x20 MHz of 2.1 GHz rights of use to incumbent licensees in return for fees that reflect the market value.
 - **Assignment Option 2C:** Administrative assignment of 2x15 MHz of 2.1 GHz rights of use to incumbent licensees and assignment of 2x15 MHz using a competitive, open, transparent auction format.

A 6.142 ComReg notes that each of the above options is not mutually exclusive and that the overall preferred option could involve one or more of the above options.⁴⁵⁵ In that regard, ComReg assesses each option individually and comes to a preliminary view on the overall preferred option at the end of this draft RIA.

A 6.143 The following sections of the draft 'Coverage RIA' consider the impact of the aforementioned regulatory options on:

- i. industry stakeholders (being existing operators and potential new entrants)

-
- Precautionary coverage obligations - where the obligations do not exceed the levels of coverage that might be expected anyway from well-functioning competition between network operators;
 - Interventionist coverage obligations - which can be expected to constrain the commercial choices of network operators and force coverage in excess of competitively determined levels

⁴⁵⁵ For example:

- Assignment Option 1 only (i.e. assign all rights of use by auction);
- Assignment Option 1 and Assignment Option 2B (i.e. assign rights of use to 2.1 GHz administratively and the remaining rights of use by auction)
- Assignment Options 1 and Assignment Option 2A (i.e. assign rights of use to 700 MHz Duplex administratively and the remaining rights of use by auction)

- ii. competition, and
- iii. consumers.

A 6.144 ComReg intends to further develop this draft RIA in light of feedback to this consultation.

Determining the impact on industry stakeholders

A 6.145 There are a number of key industry stakeholders in relation to the matters considered in this chapter:

- existing mobile operators (Vodafone, Three and Eir);
- existing FWA operators including:
 - licensees with spectrum rights of use in the 3.6 GHz band (e.g. Imagine);
 - parties which currently provide fixed wireless services using other licensed (10.6 GHz) or unlicensed (5.8 GHz) spectrum;
- other providers (small cell operators e.g. Dense Air⁴⁵⁶); and
- potential new entrants (e.g. an MNO or MVNO, or FWA operator).

Impact on stakeholders

A 6.146 A stakeholder that submitted an award proposal is likely to prefer the option that most closely reflects that proposal. Otherwise, it is reasonable to conclude that stakeholders are likely to prefer an option which would offer the greatest amount of contestable spectrum (so as to provide the greatest chance of obtaining spectrum rights). ComReg assesses each of the 3 regulatory options in turn below.

MNOs

A 6.147 MNOs have submitted a variety of different views in relation to the assignment process for the Proposed Award.

A 6.148 Vodafone supports the use of an auction as the most appropriate assignment process for this award. For example, it recently noted "*in principle the assignment of spectrum through open transparent auction processes has facilitated the roll-out of competitive mobile networks and we believe (will) be the best solution to meet customer demand for increased*

⁴⁵⁶ Dense Air provides wireless-based solutions for both 'network densification' and 'network extension' by providing 'Small Cells as a Service'.

capacity and new technologies in the future."⁴⁵⁷ Similarly, in response to Document 18/60, it generally expressed support for an auction to assign rights of use to the bands under assessment, and in its response to Document 19/59R, it supported the use of an auction for the 2.1 GHz Band at this time.

- A 6.149 Vodafone could prefer a form of administrative assignment if sufficient rights of use were assigned to it, however, it is unlikely to prefer Assignment Option 2A because such an assignment would retain the existing asymmetry of sub-1 GHz holdings between it and Three until 2030 at the earliest (when 800 MHz and 900 MHz Bands would potentially become available for reassignment). In contrast, the competition caps proposed (see Chapter 6) would provide Vodafone with the opportunity to be assigned 2x15 MHz 700 MHz Duplex compared with 2x10 MHz for Three under Assignment Option 1. Accordingly, an administrative assignment of 2x10 MHz rights of use would deny Vodafone the opportunity to reduce the existing sub 1 GHz spectrum asymmetry vis-à-vis Three. Given its stated preference for an auction, Vodafone would likely prefer Option 2C to Option 2A because Option 2C involves an auction for some of the 2.1 GHz rights of use.
- A 6.150 Therefore, in line with its stated views, Vodafone is likely to prefer the assignment of all available spectrum using a competitive, open, transparent auction format as this would provide it and other operators with an equal opportunity to access all available spectrum rights of use.
- A 6.151 In response to Document 18/74, Three expressed support in general for the use of auctions. However, it cautioned that the auction mechanism and rules must be chosen to suit the award, and that ComReg should "*start from fresh*" and consider all options for the award mechanism. Similarly, in recent correspondence submitted with its commissioned Nera Report, Three also expressed support for the use of auctions but expressed a view that ComReg should switch to what it considers to be a simpler, better adapted format (see Chapter 7 for discussion on preferred format). ComReg notes the following:
- In relation to the 2.1 GHz Band, Three is likely to prefer Assignment Option 2B given it commissioned the Nera Report.
 - In response to 19/59R, Three suggests that a cap of 2x10 MHz 700 MHz should apply to the Proposed Award. Therefore, Three may prefer an administrative assignment of 2x10 MHz of 700 MHz Duplex rights of

⁴⁵⁷ Response to Document 18/74 – Draft Spectrum Strategy Statement.

use under Option 2A (meaning it would retain its sub 1 GHz spectrum advantage over Vodafone until 2030 at the earliest);

- however, Assignment Option 2A would also involve interventionist obligations. In that regard, ComReg notes Three's view that onerous coverage obligations should be a separate and distinct stage from the assignment of spectrum.⁴⁵⁸ In particular, Three's Nera Report expressed caution against attaching onerous obligations as this would create artificial scarcity of "clean" spectrum and may distort bidding across the whole auction.

A 6.152 Overall, it would appear that Three would prefer a combination of Assignment Options. In particular it is likely to prefer the:

- assignment of 700 MHz, 2.3 GHz and 2.6 GHz rights of use through Option 1 (Auction) with 2.1 GHz assigned through Options 2B or 2C (administrative assignment); or
- assignment of 2.3 GHz and 2.6 GHz rights of use through Option 1 (Auction) with 700 MHz and 2.1 GHz administratively assigned through Option 2A and 2B/2C.

A 6.153 Eir provided a variety of views which differ depending on the band in question; however, it would appear to favour the administrative assignment of both the 700 MHz Duplex and 2.1 GHz Band for the following reasons:

- in relation to the 700 MHz Duplex, Eir is likely to prefer Assignment Option 2A as this best reflects its submission to Document 18/60;
- in relation to Assignment Option 2B, in its response to Document 18/60, Eir submitted that *"ComReg must ensure that spectrum holdings in the 2100MHz band are equalised so that no operator is allowed to maintain an unfair advantage in access to spectrum that will distort competition"*.
- Eir provided updated views in response to Document 19/59R and suggests that a more proportionate approach would be to directly assign 2x15 MHz of the 700 MHz Duplex to Eir, Three and Vodafone, with the remaining spectrum available for the Proposed Award.

A 6.154 Therefore, with respect to the 2.1 GHz Band Eir is likely to prefer Option 2B over Option 1 but Option 2C over Option 2B.

A 6.155 Overall, it would appear that Eir would prefer a combination of all

⁴⁵⁸ Three Nera Report Briefing Note to ComReg 15 January 2019,

Assignment Options (i.e. Assignment Option 1 and Assignment Option 2A and Assignment Option 2C) whereby some 2.1 GHz and all 700 MHz Duplex rights of use are assigned administratively, and remaining rights of use assigned by way of auction under Option 1.

Fixed Wireless Providers

- A 6.156 Assignment Option 2B is unlikely to be favoured by FWA operators as it would assign spectrum rights of use directly to incumbent MNOs. While Imagine expressed some tentative support for Option 2A, FWA operators would likely be at a disadvantage to incumbent mobile operators who may be better placed to deliver the interventionist mobile coverage obligations envisaged under that option.
- A 6.157 FWA operators would likely prefer Assignment Option 1 over Assignment Option 2A, 2B or 2C as it would provide for the assignment of all available spectrum rights on a service and technology neutral basis and would give all operators an equal opportunity to access spectrum. The administrative award of some, or all, of the Award Bands for mobile would exclude other providers (e.g. FWA operators) or reduce the quantum of spectrum available to FWA operators and could cause the cost of any residual spectrum rights of use to artificially increase.
- A 6.158 In that regard, Imagine would appear to prefer Assignment Option 1, This is consistent with the views expressed in its response to Document 19/59R, where it notes that *“to administratively assign such spectrum to MNOs exclusively would exacerbate the already significant distortion that exists in the market with a very substantial quantum of national spectrum already in the hands of mobile phone service operators”*. Further, in response to 18/60, Imagine (a FWA operator) submitted that a CCA is a suitable mechanism for the auction and assignment of the proposed bands given the recent experience of the CCA auction process for the 3.6 GHz band.⁴⁵⁹
- A 6.159 Therefore, ComReg remains of the preliminary view that FWA Operators would likely prefer Assignment Option 1 (Auction) and an administrative assignment would only be considered by FWA Operators if such an assignment included FWA operators.

New Entrants/Other operators

- A 6.160 Potential new entrants would likely prefer an assignment process which best facilitates new entry (which could be either an administrative assignment or auction). While potential new entrants would likely prefer a reservation of spectrum made solely for new entrants, they may, depending

⁴⁵⁹ Imagine response to Document 18/60.

on the options available, also prefer an open, transparent competitive award format for all available spectrum. In terms of the four regulatory options, new entrants are likely to prefer Assignment Option 1, as they would be given an equal opportunity to access spectrum according to their valuation of the spectrum, as expressed by their willingness to pay (i.e. there would not be any direct assignments to incumbent operators).

Impact on competition

A 6.161 The impact on competition is assessed at two levels which are interconnected:

- competition within the award process, where bidders/applicants compete with each other in order to be assigned spectrum rights; and
- downstream retail competition between winning bidders and other market participants in affected downstream markets. The promotion of competition at this level is a primary goal of the Proposed Award because competition at the retail level is ultimately what drives consumer benefits, in terms of price, quality and choice of the relevant services.

Competition within the award process

A 6.162 At a general level, subject to the award process preventing highly asymmetric outcomes (to safeguard downstream retail competition), the more intense the competition in an award process (e.g. through a greater level of participation), the higher the likelihood that the spectrum usage rights will be awarded to those operators that value it the most. Such operators are the most incentivised to use the spectrum efficiently and compete vigorously in the downstream retail market(s).

Administrative assignment

A 6.163 ComReg assesses Assignment Options (Option 2A, 2B and 2C) below.

Assignment Option 2A, Assignment Option 2B and Assignment Option 2C

A 6.164 First, any form of assignment which excludes certain users from participating in the award process reduces the level of competition within the award process. The more extensive the restriction, in terms of the possible assignment outcomes which it precludes, the more likely it is that the actual optimal assignment outcome is precluded from arising. Indeed, the request for a reservation of the band or sub-set of a band for a particular use/user in the first place suggests that more than one type of user might have participated in the award absent such reservation and/or there is an

unwillingness to pay the fees that may have arisen from a more open award process.

A 6.165 Assignment Option 2 would result in restrictions in terms of possible recipients of spectrum rights of use, given that rights of use would be assigned directly to incumbent MNOs (noting that a less extensive restriction would be to allocate to a particular use). In particular, Assignment Option 2B would exclude all other potential bidders for rights of use in the 2.1 GHz band, including new entrants⁴⁶⁰, FWA operators and/or small cell providers:

- under Assignment Option 2B, 2.1 GHz rights of use would be assigned directly to the three MNOs and there would be no competition to determine the most efficient use(s), user(s) or quantum of spectrum allocated to each⁴⁶¹. Any competition between bidders would be limited to determining frequency positions within the band. For example, Three is currently positioned at opposite⁴⁶² ends of the band and a reduction in rights of use to facilitate an increase of 2x5 MHz in the other two MNOs would likely result in preferences between bidders for different positions with the band; and
- under Assignment Option 2C, the majority (9 of 12 lots) of 2.1 GHz rights of use would be assigned directly to the three MNOs with the remainder available for auction. While this option provides for the auction of some rights of use, the administrative assignment prior to an auction would likely distort incentives that could lead to inefficient outcomes as discussed below.
- under Assignment Option 2A, 700 MHz Duplex rights of use would also be assigned directly to operators who are assessed as best

⁴⁶⁰ In the French award, if more than four applicants (number of MNOs) qualified for a band, the selection would have been based on:

- a single round sealed bid auction for the 900 MHz band;
- commitments for better coverage inside trains for the 1800 MHz band; and
- commitments for better indoor coverage for the 2 GHz band.

⁴⁶¹ Further, the quantum of spectrum allocated between the MNOs would be fixed (i.e. split equally) where (i) symmetric holdings are not required for effective competition (see Competition Caps Section 7.7), (ii) it may be more efficient for some MNOs to hold more or less spectrum as differences in quantum may allow an operator to adopt differentiated strategies/services (e.g. a small operator with a relatively large amount of spectrum in a band/s to provide higher speeds/capacity so as to grow market share).

⁴⁶² Three currently holds two separate licences to use radio spectrum in the 2100MHz band for the provision of 3G services. This situation arose following the acquisition by Three Group of Telefonica Ireland in 2014. Three is licenced to use 6 blocks in total, however they are divided into two groups of three at opposite ends of the band, given the spectrum blocks in Three's 2.1 GHz licence were not contiguous with the spectrum blocks in Telefonica's licence.

placed to deliver interventionist mobile coverage obligations. MNOs would hold significant advantages under such an assessment (given the existing rollout of mobile networks) and obligations would likely be limited to the three MNOs. Further there would be little competition to determine the most efficient use(s), user(s) or quantum of spectrum assigned to each. There could be some limited competition for additional coverage commitments in return for additional spectrum above a minimum requirement.⁴⁶³ In terms of frequency locations, any competition for specific positions within the 700 MHz band would likely be marginal as new rights of use in a “greenfield” spectrum band are unlikely to generate significant competition for positions in the band;

- In relation to other forms of administrative assignment, the lack of transparent procedures in an administrative award limits the extent of competition within the award. Specifically:
 - applicants may be unable to respond to specific commitments made by competing applicants and even where they can, the potential lack of effective objective selection criteria may make it difficult for competing applicants to determine the effectiveness of the offers (in terms of the outcome) they make; and
 - applicants may be exposed to substitution risks and be unable to increase or decrease their requirements in response to alternative rival requirements, particularly where some applicants may be indifferent between one or more bands. In this way competition between bands and during the award would be restricted.

A 6.166 Further, the administrative assignment of some or all of one or more bands could reduce competition for other bands that would be available in open competition. For example, suppose a potential new entrant had a minimum package requirement of 2x5 MHz - 700 MHz Duplex; 2x10 MHz - 2.1 GHz Band; 2x10 MHz - 2.6 GHz Band; and 2x10 MHz - 2.3 GHz Band. Under Assignment Option 2A or Assignment Option 2B, a new entrant would be unable to acquire sub 1 GHz rights of use and may not compete for any of the remaining rights of use that would have been subject to open competition. In effect, MNOs would likely benefit the most from the administrative assignment of rights of use in the 700 MHz Duplex given its incumbency advantages for delivering interventionist coverage obligations over an appropriate period. Even where a new entrant could apply under

⁴⁶³ In the French award, applicants could include additional commitments for commuting trains using 2.1 GHz Band. Applicants could also propose during the beauty contest commitments to improve indoor mobile coverage and/or to provide fixed broadband services in remote areas.

an administrative assignment process, it would be difficult for such an entrant to meet with interventionist coverage obligations in the 700 MHz Duplex in the absence of an existing network.

A 6.167 In relation to fees, under Assignment Option 2A, the assignment of 700 MHz Duplex rights of use would be provided in return for interventionist coverage obligations. However, under Assignment Option 2B, Three suggests that the price be set at market value. In that regard, it would be difficult for ComReg to make an accurate assessment of a market price that reflects the opportunity cost of the spectrum rights. This is exacerbated by the fact that usage fees, if any, prescribed under Assignment Options 2A or 2B would be unlikely to encourage licensees to return unused or underused spectrum if they did not reasonably reflect the opportunity cost of the reserved use. Therefore, absent a suitable fee structure (which would be difficult to design appropriately), there is a real risk that fees are not set at a level which ensures the efficient use of spectrum and, in turn, promotes competition.

A 6.168 In addition, whereas auctions rely on binding bids to elicit credible information from bidders as to the value they attach to spectrum as a basis for an efficient outcome, no such incentives for truthful revelation exist in the case of an administrative award. This is because parties involved would have an incentive to overstate the services delivered (and/or the value of same) from the use of the spectrum. In that context, ComReg prefers winners of spectrum rights to seek to use them efficiently based on economic incentives, rather than by potentially having to resort to sanctions/litigation to compel compliance with commitments made in seeking an administrative assignment. Moreover, if spectrum rights have been assigned at below the "*opportunity cost*", there may have been some other bidders who would have been prepared to pay more. This could be inefficient as the spectrum is not assigned at the highest value amongst alternative uses.

A 6.169 Any administrative determination of fees is not straightforward, and could lead to inefficient use and or distortions to competition since:

- prices that are set too low could lead to unfair competition with others who are paying more for their similar rights of use of spectrum; or
- prices that are set too high could lead to scarce spectrum (a valuable public resource) being unused, or under-used.

A 6.170 Further, the administrative determination of fees could lead to disputes where licensees disagree with the level of fees set administratively by the regulator. For example:

- EE challenged Ofcom's 2015 decision to set new annual licence fees in the UK. The Court of Appeal quashed Ofcom's decision and, as a result, fees reverted back to a lower level which had applied for many years⁴⁶⁴; and
- In light of the above ruling, Vodafone lodged legal proceedings against Ofcom to reclaim the fees it considers have been overpaid. A ruling in the High Court in May 2019 found in favour of Vodafone against Ofcom over the issue.⁴⁶⁵

A 6.171 In relation to Eir's suggestion, that under Option 2C, the auction price of the three 2.1 GHz Lots could be used as a reference point for pricing the administratively assigned lots, ComReg notes that this would not be appropriate. The competitive award of three lots when twelve lots are available would be unlikely to establish fees that would encourage the efficient use of the spectrum and would be open to a number of distortions depending on the demand for the spectrum.

A 6.172 For example, in the event, that only MNOs were interested in the remaining three 2.1 GHz lots:

- it would provide the MNOs with incentives to keep the price of the auction spectrum low because the price in the auction for three lots would determine the price of the nine administratively assigned lots.
- there could be reduced competition for the three remaining lots if the administratively assigned lots were sufficient to satisfy demand for one or more bidders.
- the value bidders have for three incremental 2.1 GHz Lots could be lower having already been assigned 2x15 MHz. It is unlikely that this lower price would be reflective of the value of lots already assigned administratively.
- any lower price for 2.1 GHz spectrum would distort competition for other substitutable bands (assigned by auction) by providing MNOs with additional resources (which under normal competition they would not have) to compete against other operators and potential new entrants.

A 6.173 Alternatively, if bidders other than MNOs competed for the remaining three lots:

⁴⁶⁴ <https://www.ft.com/content/6ab98d6a-cf85-11e7-b781-794ce08b24dc>

⁴⁶⁵ <https://www.ft.com/content/e4a22ff4-78be-11e9-be7d-6d846537acab>

- the residual spectrum could be at a higher price to reflect the opportunity cost of the spectrum in that award and to reflect the artificial reduction in supply caused by the reservation. This would impose a price above the opportunity cost for all bidders, including MNOs.
- it would create incentives for MNOs not to compete for additional lots with other bidders given the impact this would have on the price for the administratively assigned lots (i.e. MNOs may strategically reduce demand resulting in the assignment of one or more lots to a potentially less efficient user at a lower price).

A 6.174 More generally, MNOs would have agreed to be administratively assigned rights of use for a 20 year period without knowing the price of that spectrum because the administrative assignment of rights of use to incumbents would occur before the auction of the remaining rights of use.

A 6.175 In relation to interventionist coverage commitments associated with Assignment Option 2A, ComReg discusses, in detail, its views in relation to appropriate coverage obligations in Chapter 7. ComReg observes that Assignment Option 2A would appear to involve a symmetric obligation across all three operators given Eir's suggestion of 2x10 MHz each. However, as noted by DotEcon⁴⁶⁶, applying interventionist coverage obligations symmetrically could reduce participation and competition in spectrum awards. Among other things, there may be operators (either existing MNOs, potential new entrants, or FWA operators) unable to meet such an obligation and, if so, imposing the obligation on all potential bidders might prevent some parties participating altogether when it might have been socially optimal for them to be awarded spectrum. Alternatively, an administrative award with a symmetric obligation (where one operator is provided 2x10 MHz in return for coverage commitments) might not be favoured by certain MNOs if only one operator would be assigned rights of use directly with the remainder assigned by auction.

A 6.176 Further, because there is a limited field of potential suppliers of coverage (i.e. existing MNOs), this would likely weaken competition and lead to sub-optimal coverage outcomes. In particular, the administrative procurement of coverage would require the regulator to assess the costs associated with providing coverage and there would be significant questions about the extent to which each operator would be capable of extending services to a determined level. Such an assessment across competing operators would require, at a minimum, detailed information about existing networks and

⁴⁶⁶ Coverage obligations and spectrum awards a report from DotEcon Ltd, Document 18/103d, Section 2.6.

expectations about how such operators would rollout services in the future. For example, bidders may have different net costs of providing additional coverage where smaller networks may be less able to partially offset the costs of improved coverage or quality of service. In that regard, some bidders may be better able to meet coverage requirements than others, leading to reduced competition and potentially poor value for money in the provision of better coverage.

A 6.177 It would therefore be very difficult for the regulator to make an accurate assessment of what additional coverage would be required above what would be delivered on a commercial basis and there is a risk that spectrum would be assigned inefficiently if coverage obligations were not met. This approach also creates perverse incentives by creating a risk of applicants exaggerating future business cases to boost their chances of being assigned spectrum directly. In this way, certain operators could be able to distort competition within the award and gain additional rights of use that are not reflected in underlying efficiency and ability to deliver additional coverage efficiently.

Assignment Option 1 (Auction)

A 6.178 Auctions typically take a service and technology neutral approach allowing all credible bidders to compete for the same spectrum rights. As such, they can be beneficial in terms of:

- removing the burden on the regulator to make complex judgements (based on incomplete/imperfect information) in relation to assigning the spectrum and the suitable level of fees. In particular, auctions are better at eliciting relevant information about the value (and efficient assignment) of the spectrum that is likely not available to the regulator, e.g. the value that different undertakings place on those rights of use, in light of the potential different uses (and networks/technologies for same) and business cases for same etc., over the lifetime of the rights of use;
- incentivising bidders to reveal information about their preferences and valuation of spectrum through their willingness to pay also enables rights of use to be assigned to the bidders who value them most, and who are, in turn, sufficiently incentivised to use the spectrum most efficiently and compete vigorously in the downstream retail market/s';
- ensuring that all potential acquirers of the spectrum rights can compete on an equal basis for all available spectrum, and not

artificially on the basis of any measures designed to favour incumbency for example;

- promoting competition during the award and allowing bidders to switch back and forth across complementary and/or substitutable bands in response to the evolution of prices and valuations of other bidders. In that regard, it is desirable to allow bidders to switch between different bands as the award process progresses as the choices made by bidders are not static and likely vary depending on the choices made by other bidders.
- allowing the market to determine the specific frequency assignments for each winning bidder, which should promote efficient assignments based on information about bidders' preferences that would otherwise not be available to the regulator. In that regard, ComReg notes that in previous similar awards, preferences existed across different parts of the bands as evidenced by the assignment bids received (26 GHz band – 2017⁴⁶⁷, 3.6 GHz band– 2016⁴⁶⁸ and 2012 MBSA⁴⁶⁹).

A 6.179 In relation to fees, where demand for spectrum is likely to be greater than supply, the use of a market mechanism for assignment⁴⁷⁰ (such as a well-designed auction with prices set on the basis of opportunity cost⁴⁷¹) can help to:

- establish the efficient assignment of spectrum amongst bidders, based on bidders' willingness to pay (which can be expected to reflect the economic value they are able to generate);
- establish the opportunity costs of the assignment, setting suitable spectrum usage fees at a level that represents market value (and could be considered fair) and encourages the winning bidder(s) to utilise the spectrum more efficiently, including incentivising the return of unused or underused spectrum to the regulator; and

⁴⁶⁷ Vodafone paid an additional price of €200,000 for specific frequency assignments.

<https://www.comreg.ie/publication/results-of-the-26-ghz-spectrum-award-2018/>

⁴⁶⁸ For example, Vodafone paid an additional price of € 230,012 for specific frequency assignments. <https://www.comreg.ie/publication/results-3-6-ghz-band-spectrum-award-2/>

⁴⁶⁹ For example, Meteor, Telefonica and Vodafone paid €89,136, €300,058 and €2,109,275 for specific frequency assignments. https://www.comreg.ie/?dlm_download=frequency-arrangements-and-results-of-the-multi-band-spectrum-award-process

⁴⁷⁰ Wherever spectrum is scarce, this implies that there is an 'opportunity cost' associated with distributing the spectrum to particular uses and users.

⁴⁷¹ Efficient spectrum assignment generally requires rights of use to be assigned to those users able to make the best economic use of it, and for the users of the assigned spectrum to make use of it in the way that generates the greatest social benefit.

- significantly reduce the risk of subsequent challenges on the level of fees required to provide for optimal use because the final prices also represent the level at which winners are willing to pay for the spectrum rights;

A 6.180 Separately, auctions can be designed so that, if there is an excess of spectrum over the aggregate demand from all bidders in the first round, they degenerate into a simple administrative assignment. This has been the case with a number of ComReg's previous auctions.

A 6.181 Coverage obligations should not exceed the levels of coverage that might be expected anyway from well-functioning competition between network operators and therefore should not impact competition within an auction. However, where coverage in excess of competitively determined levels is required (as would seem to be suggested by Eir under Assignment Option 2A)⁴⁷² auctions can lead to certain unavoidable distortions, including that:

- such obligations may exacerbate asymmetries between bidders, in that some bidders may be more able to meet the obligations than others (indeed some bidders may not be able to deliver such coverage obligations at all);
- such obligations could create an opportunity for an operator to exploit its relatively strong position in competing for a coverage lot to leverage its cost advantage to obtain more spectrum; and,
- it is possible that the winner of a coverage lot gets a discount on spectrum in return for a coverage level it would have provided anyway (i.e. an undue benefit).

A 6.182 In contrast, auction formats offer flexibility and, depending on the willingness to pay for additional coverage, DotEcon advises that there are options for how such obligations might be provided which would ensure that distortions of the spectrum award process are kept to a minimum. For example, DotEcon states that "*Auctions offer considerable flexibility to resolve some of these problems. Although seldom used to date, auctions have the potential to explore award of alternative levels and forms of coverage obligation depending on their relative cost.*"⁴⁷³ In particular, and depending on the particular circumstances, it may be possible to split the award of spectrum and the procurement of a coverage improvement into

⁴⁷² Eir refer to the French example where rights of use were assigned with an agreement to accelerate mobile coverage without going through an auction and the State giving up future income. The foregone auction revenue reflecting the cost to network operators of meeting the obligation to extend coverage.

⁴⁷³ Coverage obligations and spectrum awards a report from DotEcon Ltd, Document 18/103d, published November 2018.

two stages within an award process or to procure a coverage obligation in an entirely separate process either before or after the award of spectrum. This would usefully allow bidders to compete on the basis of providing coverage rather than making bids in order to receive spectrum rights of use.

A 6.183 Therefore, and for the reasons stated above, ComReg is of the preliminary view that Assignment Option 2 (Auction) would, on balance, better promote competition within the award process (even where “interventionist”-type coverage obligations are required).

Competition in downstream markets

Administrative Assignment (Options 2A, 2B and 2C)

A 6.184 Whilst only granting spectrum rights of use to specific parties or category, such as MNOs (or other operators), could be appropriate if the supply of spectrum is likely to exceed demand for same, doing so where demand is likely to exceed supply (such as this Proposed Award), runs the risk of the assigned spectrum being used inefficiently and/or distorting downstream competition.

A 6.185 In that regard, ComReg observes that over the duration of the rights of use the basis for competition could change or shift from the data rates and prices offered by the different platforms towards converged services and content demanded by end-users. Additionally, in terms of technology both mobile and FWA operators are converging in terms of transmission standards, with both sectors moving towards adoption of LTE technology and in the future to 5G standards. In such circumstances, Option 2B (and effectively 2A given the requirement for interventionist mobile coverage obligations) would deny rights of use to other operators (FWA operators or small cell operators) and/or new entrants⁴⁷⁴. This would place such bidders who may have the potential to provide a more efficient and differentiated range of services at a disadvantage by reducing the overall amount of spectrum in the award or even exclude them altogether from certain bands. This could act as a barrier to innovation, entry and/or expansion if such applicants were excluded from applying for some or all spectrum.

A 6.186 Certain applicants might use spectrum rights of use less efficiently than others would have (had they succeeded in acquiring it), particularly in light of the convergence of services and technologies in the future. Option 2C would likely be preferable than Option 2B as some 2.1 GHz rights of use would be made available for auction allowing other users and new entrants the opportunity to be assigned some 2.1 GHz rights of use. However, this option would artificially reduce the supply of spectrum to those users such

⁴⁷⁴ Potential new entrants who do not currently provide any services using spectrum in the State

as potential new entrants.

- A 6.187 ComReg cannot rule out the possibility of new entry across any of the relevant downstream markets. For example the 3.6 GHz Award resulted in one incumbent FWA operator (Imagine), three MNOs and a new small-cell operator obtaining spectrum rights of use. Furthermore, ComReg notes that the acquisition of Telefónica Ireland by Hutchison 3G⁴⁷⁵ contains a commitment to offer divestment spectrum⁴⁷⁶ to the Upfront⁴⁷⁷ (or Second MVNO⁴⁷⁸) and any such MVNO may wish to be assigned additional rights of use as part of the proposed award process. Assigning rights of use to incumbents would deny such entrants or any other new entrant the opportunity to acquire additional rights of use in the proposed bands.
- A 6.188 Second, ComReg further observes that even the administrative assignment to incumbents has the potential to create inefficient outcomes. For example, as Assignment Option 2B would involve the assignment of a symmetric quantum of rights to the incumbents, it would necessarily preclude asymmetric outcomes which may have been more efficient in terms of better promoting competition. As noted in Chapter 7, ComReg observes that asymmetric outcomes may be compatible with a diversity of operators engaging in effective downstream competition provided the asymmetry is not too extreme.
- A 6.189 More generally, an assignment of spectrum to less efficient operators under an administrative assignment and as could occur in Options 2A, 2B and 2C could lead to reduced competition and, consequently, lower quality services being offered by less efficient operators.. If such an award process fails to deliver an efficient outcome there may well be a negative impact on downstream competition. Therefore, there is a risk that applicants seeking to provide services to consumers may be awarded less spectrum than would be efficient, or none at all, while less efficient operators are awarded more rights of use than would be efficient in a competitive market.
- A 6.190 In relation to more interventionist coverage commitments envisaged under Option 2A, MNOs would have particular incumbency advantages that would favour the assignment of rights of use to there. Further, the extent to which

⁴⁷⁵ Case No COMP/M.6992 HUTCHISON 3G UK / TELEFONICA IRELAND.

⁴⁷⁶ The Divestment Spectrum available is:

- (a) 2x5 MHz of 900 MHz spectrum in Time Slice 2 (13 July 2015 to 12 July 2030);
- (b) 2x10 MHz of 1800 MHz spectrum in Time Slice 2 (13 July 2015 to 12 July 2030); and
- (c) 2x10 MHz of 2100 MHz spectrum for the remainder of the licence period until 24 July 2022.

⁴⁷⁷ The Upfront MVNO is Virgin Mobile which currently has around [x< [REDACTED] x<] customers and [x< [REDACTED] x<] market share (excluding MBB and M2M). – ComReg Quarterly Reports.

⁴⁷⁸ The Second MVNO 'ID Mobile' ceased offering services in April 2018. <https://www.comreg.ie/id-mobile-ceasing-services/>

an obligation could be delivered by such operators would likely depend on a number of factors including existing network densification and rights of use already assigned. Since it is more cost effective to add spectrum (compared to densifying the network) any decisions taken by a regulator could distort competition by assigning comparable rights of use to MNOs who have been slower or less efficient compared to competing networks.⁴⁷⁹

A 6.191 Further, ComReg notes DotEcon's advice that applying interventionist obligations asymmetrically (i.e. only to a subset of network operators, or to just one) helps to avoid inefficient duplication of networks in rural areas, where the demand density is low and natural monopoly conditions are likely to apply due to strong scale economies in very lightly loaded networks. In that context, ComReg observes that should interventionist obligations be appropriate, then an auction format would be capable of providing for such outcomes while also assigning rights of use efficiently and preventing distortions to competition.

A 6.192 Options 2A and 2B and 2C could also compromise efficient investments already made and also create investment distortions in the future if incumbents have an expectation that future rights of use will be assigned to them exclusively.

Assignment Option 1 (Auction)

A 6.193 Under Assignment Option 1, all existing operators (fixed and mobile) and potential new entrants would be afforded the same opportunities to compete for, acquire, and use spectrum rights (subject to any competition caps). As such, an auction would, firstly, avoid issues around having to make any *ex-ante* determinations as to the most efficient users or service providers, particularly where the regulator does not have perfect information.

A 6.194 Auctions can entail the risk that bidders may try to reduce or distort the competitiveness of the auction in order to restrict the total number of winning bidders and so gain a competitive advantage (e.g. by preventing new entry or foreclosing access to spectrum required by incumbents to maintain or enhance existing services) and/or to reduce the amounts paid by winning bidders. This could restrict the number of undertakings capable of providing downstream retail services which, in turn, could reduce competition in the provision of those services. As a result, consumers could have less choice and some services may be of relatively low quality, because the service

⁴⁷⁹ The availability of spectrum, demand for throughput, cost of denser networks and more spectrally efficient radio systems together result in an optimum configuration at any point in time. As spectrum is finite but network density is variable it is important that operators are incentivized to use it efficiently. Very low cost would incentivize inefficient use.

providers lack sufficient spectrum to provide services.

A 6.195 However, auctions can also include measures designed to safeguard and promote competition in downstream markets to the ultimate benefit of end users. For example, the use of competition caps to prevent extreme asymmetric outcomes and minimum prices to reduce incentives for bidders to engage in strategic behaviour during an auction to decrease the eventual price(s) paid⁴⁸⁰. This includes tacit collusion during an auction and arrangements entered into before an auction begins and which are aimed at reducing competition between bidders.⁴⁸¹ Other measures to reduce collusion include having a carefully designed information policy.

A 6.196 In relation to interventionist coverage obligations envisaged under Option 2A, auctions can also be designed to be sufficiently flexible to allow for market testing of coverage obligations at different levels and of different forms and ensuring that value for money is obtained in the provision of coverage (i.e. a winning bidder delivers the maximum amount of coverage relative to other competing bidders and that it is awarded only if the cost of doing so is not too high). As noted by DotEcon⁴⁸², it is possible to procure a coverage obligation in an entirely separate process either before or after an award of spectrum. Because the provision of coverage is based on a bidder's private valuation of delivering that coverage (rather than the value of the spectrum), as opposed to an assessment by the regulator, the extent to which such obligations are delivered upon is higher as a bidder's private valuation would be based on the costs of delivering that coverage.

A 6.197 Therefore, and for the reasons stated above, ComReg is of the preliminary view that Assignment Option 1 would, on balance, better promote downstream competition.

Impact on consumers

A 6.198 Generally, consumers will prefer the option which has the greatest potential to promote competition, thereby maximising the long term benefits to consumers in terms of choice, price, and quality. They are also likely to favour options which avoid or minimise any disruption to existing services.

⁴⁸⁰ Note also that minimum prices that are too high might have a negative impact on competition if smaller participant/new entrants are discouraged from participating, so there is a balance as discussed in Chapter 7 below.

⁴⁸¹ See Section 4.3 DotEcon Report 17/85a.

⁴⁸² Document 18/103d, Coverage obligations and spectrum awards a report from DotEcon Ltd, Section 5.2.

Assignment Option 2 (Administrative assignment)

- A 6.199 The administrative assignment of spectrum rights of use is likely to be beneficial to consumers where sufficient spectrum is available to satisfy all possible licensees and services, and those services are made available to consumers on an equal basis. Similarly, short term assignments may be beneficial in order to prevent significant disruption to existing services^{483 484} or to facilitate the efficient assignment of longer term rights of use⁴⁸⁵. However, as noted above, demand is likely to exceed supply in the present case, and an administrative assignment to certain operators under Assignment Options 2A, 2B or 2C would deny such spectrum to other potential providers of services, including potentially more efficient providers of services whose services consumers may be interested in receiving (e.g. mobile or fixed wireless broadband).
- A 6.200 Consumers could be negatively impacted if the administrative assignment of spectrum resulted in restricting other potential services. Options 2B and 2C runs the risk of assigning rights of use to MNOs when an assignment to alternative operators could have been the more efficient and more beneficial outcome to consumers. Any negative impact of the administrative assignment of rights of use would fall on consumers⁴⁸⁶ and even a relatively small negative effect could result in a substantial aggregate loss over the duration of the new rights of use. Further, as discussed previously, fees set administratively may not provide appropriate incentives for operators to use spectrum efficiently over the duration of the spectrum rights. Such a scenario could be damaging where an operator does not return unused rights of use when it would have done so if the fees were set appropriately (denying access to other operators that could deliver services more efficiently).
- A 6.201 In relation to interventionist coverage obligations, the potential to deliver on commitments made in terms of coverage, rollout or investment ultimately affects the delivery of services to consumers and an effective ex-ante mechanism to enforce the commitments made by applicants is difficult to achieve under Assignment Option 2A. In contrast, under Assignment Option 1, the use of binding bids ensures that bidders are committed to the bids they make, incentivising the delivery of services from the use of the

⁴⁸³ Interim 1800 MHz Rights of Use for the period 1 January 2015 to 12 July 2015 Consultation and Draft Decision, published April 2014.

⁴⁸⁴ ComReg observes that the potential for service continuity issues to arise can also be addressed by non-award measures, such as the proposed transition arrangements and rules outlined in Chapter 9.

⁴⁸⁵ See Chapter 5 for issues arising in the 2.1 GHz.

⁴⁸⁶ Such effects could include higher prices and less choice than might otherwise have been available; and poorer quality services than might have been achieved with a more efficient spectrum assignment.

assigned spectrum. Further, where commitments on coverage are made by incumbents in return for spectrum rights of use, such coverage, or a portion of it might ultimately have been provided absent such an assignment, and better coverage outcomes could have been obtained for consumers through a specific coverage procurement process after the competitive assignment of rights of use.

Assignment Option 1 (Auction)

A 6.202 As noted above, auctions are more likely to have a positive impact on downstream retail competition. By extension, this should benefit consumers through providing better choice, quality and pricing of services. By opening up the opportunity to obtain rights to use to all interested parties, an auction provides for a broader range of outcomes, including for differentiated services and/or technologies to be delivered in a timely manner.⁴⁸⁷ It would also reduce risk of challenge from unsuccessful applicants as to the evaluation process and / or outcome of a beauty contest (on the basis of insufficient transparency, objectivity, due diligence, etc.) and delays resulting from such challenges. In contrast to an administrative assignment, the use of binding bids in an auction ensures that bidders are committed to the bids they make, incentivising the delivery of services from the use of the assigned spectrum.

A 6.203 Further, as noted above, auctions can also be used to procure additional coverage where required. Coverage outcomes are likely to be greater through a competitive process as bidders are able to price the anticipated cost to network operators of meeting the obligation to extend coverage. This is in contrast to the administrative determination of coverage where there is the potential for winner(s) of the coverage requirement to obtain spectrum rights (at reduced or no fees) in return for a coverage level it would have provided anyway.

A 6.204 In summary, auctions offer the following benefits, relative to an administrative assignment:

- all of the bands would be offered to all bidders and non-incumbents would not be restricted from participating;
- an auction better ensures that spectrum rights are assigned to those who most value those rights, and who are therefore most incentivised

⁴⁸⁷ Consumers are more likely to gain access to the services in a timely manner, as the market mechanism in option 1 reduces the likelihood of challenge from dissatisfied bidders (which may delay the ultimate delivery of services to consumers).

to maximise consumer welfare by using their assigned spectrum efficiently;

- an auction is more likely to ensure that none of the bidders are dissatisfied with the outcome, thereby minimising the prospect of delays due to litigation etc.; and

A 6.205 An auction can assign spectrum more efficiently and also cater for interventionist coverage obligations without compromising the efficient assignment of spectrum and creating distortions to competition. An auction should therefore have the most positive impact on downstream retail competition and should therefore promote the interests of consumers in terms of the choice, price, and quality of electronic communications services.

A 6.206 ComReg is therefore of the preliminary view that consumers would, on balance, prefer Assignment Option 1 over the other assignment options.

Preferred option – Assignment Process RIA (Step 5)

A 6.207 This assessment has considered the impact of the various options from the perspective of industry stakeholders, as well as the impact on competition and consumers, and should aid stakeholders' understanding of the relative merits of the alternative assignment formats.

A 6.208 For the reasons outlined in this draft RIA, ComReg's preferred option under the Assignment Process RIA is to assign the relevant spectrum rights by way of an appropriately designed auction.

A6.6 Overall Preferred Option

A 6.209 In light of the preceding two draft RIAs and having had regard to the responses to Document 19/57R, ComReg remains of the preliminary view that spectrum rights of use in the 700 MHz Duplex, 2.1 GHz, 2.3 GHz and 2.6 GHz bands should be assigned by way of an appropriately designed auction ("Overall Preferred Option").

A 6.210 In Chapter 6 of this document, ComReg considers a number of different types of competitive auction formats for the Proposed Award.

A 6.211 The following section assesses the Overall Preferred Option against ComReg's other relevant functions, objectives and duties.

A6.7 Assessment of Preferred Option against ComReg's

other relevant functions, objectives and duties

A 6.212 The draft RIAs considered a number of options potentially available to ComReg within the context of the RIA analytical framework as set out in the ComReg's RIA Guidelines (i.e. impact on industry stakeholders, impact on competition and impact on consumers). It necessarily also involved an analysis of the extent to which various options would serve to facilitate ComReg in achieving certain statutory objectives in the exercise of its functions. In particular, it involved an analysis of the extent to which the various options would serve to promote competition and ensure that there would be no distortion or restriction of competition in the electronic communications sector, whilst at the same time encouraging efficient investment in infrastructure, promoting innovation and ensuring the efficient use and effective management of the radio frequency spectrum. This would enable ComReg to ensure that users would derive maximum benefit in terms of choice, price and quality.

A 6.213 In this section, ComReg assesses the Overall Preferred Option in the context of other statutory provisions relevant to the management of Ireland's radio frequency spectrum (which are summarised in Annex 2 of this document). It is not proposed to exhaustively reproduce those statutory provisions here. However, set out below is a summary of all statutory provisions which ComReg considers to be particularly relevant to the management and use of the radio frequency spectrum with an assessment (to the extent not already dealt with as part of the draft RIAs) of whether, and to what extent, the Overall Preferred Option accords with those provisions. In carrying out this assessment, ComReg has highlighted below some of the relative merits / drawbacks which would arise if it was to select some of the alternative options assessed under the draft RIA above.

A 6.214 For the purposes of this section, the statutory provisions which ComReg considers to be particularly relevant to the management of the radio frequency spectrum in the State are grouped as follows:

- general provisions on competition;
- contributing to the development of the internal market;
- to promote the interest of users within the Community;
- efficient use and effective management of spectrum;
- regulatory principles;
- relevant Policy Directions and Policy Statements; and

- general guiding principles (in terms of spectrum management, setting of fees and licence conditions):
 - Objective justification;
 - Transparency;
 - Non-discrimination; and
 - Proportionality.

General Provisions on Competition

A 6.215 There is a natural overlap between the aims of the draft RIAs and an assessment of ComReg's compliance with some of its statutory obligations and, in particular, one of its core statutory objectives under section 12 of the 2002 Act of promoting competition by, among other things:

- ensuring that users derive maximum benefit in terms of choice, price and quality;
- ensuring that there is no distortion or restriction of competition in the electronic communications sector;
- encouraging efficient use and ensuring effective management of radio frequencies;
- ensuring that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality; and
- ensuring that, in the transmission of content, there is no distortion or restriction of competition in the electronic communications sector.⁴⁸⁸

A 6.216 There are also other various statutory provisions requiring ComReg generally to promote and safeguard competition in the electronic communications sector including:

- Regulation 16(2) of the Framework Regulations which requires ComReg to apply objective, transparent, non-discriminatory and proportionate regulatory principles by safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure based competition;

⁴⁸⁸ The final two statutory obligations were introduced by Regulation 16 of the Framework Regulations.

- Regulation 9(11) of the Authorisation Regulations which requires ComReg to ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies;
- Article 4 of Directive 2002/77/EC (Competition Directive) which requires ComReg to refrain from granting exclusive or special rights of use of radio frequencies for the provision of electronic communications services; and
- General Policy Direction No. 1 on Competition (2 April 2004) which requires ComReg to focus on the promotion of competition as a key objective, including removing barriers to market entry and supporting new entry (both by new players and entry to new sectors by existing players).

A 6.217 Based on the draft RIAs, ComReg's preliminary view is that the Overall Preferred Option is the one that would best safeguard and promote competition to the benefit of consumers.

Contributing to the development of the Internal Market

A 6.218 In achieving the objective of contributing to the development of the Internal Market, another of ComReg's core statutory objectives under section 12 of the 2002 Act, ComReg considers that the following factors are of particular relevance in the context of this award process:

- the extent to which the Overall Preferred Option would enable ComReg to ensure that harmonisation of the use of radio frequency spectrum across the EU is promoted, consistent with the need to ensure its effective and efficient use and in pursuit of benefits for the consumer such as economies of scale and interoperability of services, having regard to all decisions and measures adopted by the European Commission in accordance with the Radio Spectrum Decision⁴⁸⁹ (Regulation 17 of the Framework Regulations);
- the extent to which the Overall Preferred Option would encourage the establishment and development of trans-European networks and the interoperability of pan-European services, in particular by facilitating, or not distorting or restricting, entry to the Irish market by electronic communication services providers based or operating in other Member States; and

⁴⁸⁹ Decision No. 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the EU.

- in order to ensure the development of consistent regulatory practice and the consistent application of EU law, the extent to which ComReg has had due regard to the views of the European Commission, BEREC and other Member States in relevant matters, in selecting an option and considering any regulatory action required by ComReg in respect of such an option.

Promoting harmonised use of radio frequency spectrum across the EU

A 6.219 In relation to the first factor identified above, for the reasons set out in the draft 'Spectrum for Award' RIA, it is ComReg's preliminary view that the Overall Preferred Option would result in the award of harmonised spectrum rights of use in the selected bands which are suitable for the provision of advanced WBB services. In this regard, the Overall Preferred Option is consistent with and promotes the objectives of the relevant harmonisation decisions of the European Commission which emphasise the suitability of this band for WBB services.

Encouraging the establishment and development of trans-European networks and the interoperability of pan-European Services

A 6.220 ComReg notes the overlap between this objective and the objective of promoting competition in the provision of ECN/ECS. Encouraging the establishment and development of trans-European networks requires that operators from other Member States seeking to develop such networks are given a fair and reasonable opportunity to obtain spectrum rights of use required for such networks and, particularly, access to critical spectrum rights of use. Accordingly, options which would restrict or distort competition or otherwise unfairly discriminate against potential entrants (such as through administrative assignment of rights of use to critical spectrum to incumbent operators) would not, in ComReg's view, satisfy the requirements of this objective.

A 6.221 In this regard, ComReg refers to the 'Spectrum for Award' draft RIA and its preliminary finding that the Overall Preferred Option is likely to be preferred by new entrants. This is because the Overall Preferred Option would not involve an administrative assignment of valuable spectrum rights that is more likely to favour incumbents simply by virtue of their incumbency, with the associated disincentives for potential participation by undertakings from other Member States in the proposed award process.

Promoting the development of consistent regulatory practice and the consistent application of EU law

A 6.222 In relation to this aspect of contributing to the development of the internal

market, ComReg continues to cooperate with other National Regulatory Authorities (“NRAs”), including closely monitoring developments in other Member States to ensure the development of consistent regulatory practice and consistent implementation of the relevant EC harmonisation measures and relevant aspects of the Common Regulatory Framework.

A 6.223 For instance, ComReg has had clear regard to international developments in the context of:

- promoting the provision of WBB services;
- considering whether to include other potential bands in the award process;
- harmonisation developments and equipment availability in relation to the potential candidate bands;
- licence durations for spectrum rights in the selected bands; and
- licence fees (and benchmarking in particular).

A 6.224 Furthermore, ComReg will continue to have regard to international developments as appropriate. In the present case, ComReg considers that the Overall Preferred Option is consistent with the approaches taken by and being considered in other Member States.

Promote the interest of users within the Community

A 6.225 The impact of the Overall Preferred Option and other options on users from a more general perspective and in the context of ComReg’s objective to promote competition has been considered in the context of the above draft RIAs and it is not proposed to consider this matter further here.

A 6.226 ComReg also observes that the majority of measures set out in Section 12(2)(i) to (vii) of the 2002 Act, aimed at achieving this statutory objective, are more relevant to consumer protection, rather than to the management of the radio frequency spectrum.

Efficient Use and Effective Management of Spectrum

A 6.227 Under section 10 of the 2002 Act, it is one of ComReg’s functions to manage the radio frequency spectrum in accordance with a Policy Direction under section 13 of the 2002 Act. Policy Direction No. 11 of 21 February 2003 requires ComReg to ensure that, in managing spectrum, it takes account of the interests of all users of the radio frequency spectrum (including both commercial and non-commercial users) (see discussion on this policy

direction below). Importantly, in pursuing its objective to promote competition under section 12(2)(a), ComReg must also take all reasonable measures to encourage efficient use and ensure effective management of radio frequencies. Section 12(3) of the 2002 Act also requires that measures taken with regard to encouraging the efficient use and ensuring the effective management of radio frequencies must be proportionate.

A 6.228 Regulation 9(11) of the Authorisation Regulations also provides that ComReg must ensure that radio frequencies are efficiently and effectively used having regard to section 12(2)(a) of the 2002 Act and Regulations 16(1) and 17(1) of the Framework Regulations.

A 6.229 In relation to Policy Direction No. 11, the draft RIAs set out above take into account the interests of all users of the radio frequency spectrum (and assesses the extent to which such interests are consistent with ComReg's own statutory obligations), both commercial and non-commercial. ComReg is of the view that the Overall Preferred Option is one that would safeguard and promote those interests.

A 6.230 In addition, the preferred spectrum assignment process (an auction) best facilitates efficient new entry, and encourages an efficient use of spectrum by those successful in the proposed assignment process. This is because an auction would ensure that, subject to reasonable constraints inherent in the design of an auction (e.g. spectrum competition caps), those who value the spectrum rights the most will win same and, because of these financial incentives, are the most likely to use the spectrum efficiently.

A 6.231 In that light, ComReg is of the view that the Overall Preferred Option complies with the obligations contained in the above statutory provisions. ComReg is also of the view that the alternative spectrum and assignment options considered would fail to satisfy the above provisions to the same extent, if at all.

Regulatory Principles

A 6.232 Under Regulation 16(2) of the Framework Regulations, ComReg must, in pursuit of its objectives under Regulation 16(1) and section 12 of the 2002 Act, apply objective, transparent, non-discriminatory and proportionate regulatory principles by, amongst other things:⁴⁹⁰

⁴⁹⁰ Some of those principles listed in 16(2) are not listed here because they are either dealt with elsewhere in this chapter or were considered by ComReg as not being relevant to the Proposed Award.

- promoting regulatory predictability by ensuring a consistent regulatory approach over appropriate review periods; and
- promoting efficient investment and innovation in new and enhanced infrastructures, including by ensuring that any access obligation takes appropriate account of the risk incurred by the investing undertakings and by permitting various cooperative arrangements between investors and parties seeking access to diversify the risk of investment, whilst ensuring that competition in the market and the principle of non-discrimination are preserved.

Regulatory Predictability

A 6.233 ComReg notes that it places importance generally on promoting regulatory predictability and, as illustrated below, has complied with this principle in carrying out the current process.

A 6.234 In the present context, ComReg considers the following objectives to be of particular importance to achieving the aims of this regulatory principle:

- promoting regulatory predictability in relation to availability of spectrum rights to other users of spectrum by applying an open, transparent, and non-discriminatory approach to spectrum release; and
- promoting regulatory predictability by, to the extent appropriate, taking a consistent approach to the award of spectrum in Proposed Award as that taken in other recent spectrum awards.

A 6.235 In relation to the first objective, ComReg notes that the Overall Preferred Option ensures that the rights of use to the proposed harmonised bands are made available. This would give the market the utmost transparency and predictability in terms of the availability of those rights. The alternative of potentially delaying the award of rights of use in these bands would not, in ComReg's view, contribute to the promotion of regulatory predictability.

A 6.236 In relation to the second objective, ComReg considers that the alternative options would not promote regulatory predictability due to the inherent uncertainties attached to administratively determining key parameters such as spectrum assignments and fees, particularly in the context of competing demands from stakeholders, imperfect information and the lengthy duration of the spectrum rights at issue. Rather, relying on a full market based mechanism (with objective, transparent, non-discriminatory and proportionate rules) to assign rights of use in a large amount of valuable spectrum across a range of bands better promotes regulatory predictability.

In that regard, relevant industry stakeholders (e.g. MNOs, FWA operators etc.) are becoming increasingly familiar with competitive auction processes and the use of such processes should contribute to regulatory predictability.

A 6.237 In addition, ComReg considers that the Overall Preferred Option – which, amongst other things, facilitates potentially significant variations in demand characteristics through the inclusion of TDD and FDD spectrum to accommodate uplink and downlink capacity requirements, and would incorporate appropriate spectrum caps informed by this consultation to facilitate advanced WBB service provision while avoiding extreme outcomes – would better minimise the risk of award participants failing to win their desired spectrum assignments for reasons other than competitive tension within the award.

A 6.238 In light of the above, ComReg is of the view that the Overall Preferred Option complies with the regulatory principle of promoting regulatory predictability.

Promoting Efficient Investment and Innovation in New and Enhanced Infrastructures

A 6.239 ComReg considers that the Overall Preferred Option is consistent with the aims of this regulatory principle because it:

- has the capacity to facilitate a fully competitive release of the selected bands at the earliest possible opportunity. Providing clarity around the availability of these bands as soon as possible ensures that winners of rights of use are appropriately incentivised to efficiently invest in new and enhanced infrastructures, to deploy new technologies and to provide advanced WBB services to end users, while avoiding the potential costs, uncertainties and inefficiencies associated with a delayed release of such rights; and
- would give participants the scope to bid according to their own valuation of the spectrum rights, based on their own business plans and market and financial positions, and thus to invest efficiently.

Relevant Policy Directions and Policy Statements

A 6.240 ComReg has taken due account of the Spectrum Policy Statement issued by the then DCENR in September 2010 and its Consultation on Spectrum Policy Priorities issued in July 2014. ComReg notes that the core policy objectives, principles and priorities set out therein are broadly in line with those set out in the 2002 Act and in the Common Regulatory Framework and, in turn, with those followed by ComReg in identifying the Overall

Preferred Option.

A 6.241 Section 12(4) of the 2002 Act requires ComReg, in carrying out its functions, to have regard to policy statements, published by or on behalf of the Government or a Minister of the Government and notified to it, in relation to the economic and social development of the State. Section 13 of the 2002 Act requires ComReg to comply with any policy direction given to ComReg by the Minister as he or she considers appropriate to be followed by ComReg in the exercise of its functions.

A 6.242 ComReg considers below those Policy Directions which are most relevant in this regard (and which have not been considered elsewhere in this chapter).

Policy Direction No.3 of 21 February 2003 on Broadband Electronic Communication Networks

A 6.243 This Policy Direction provides that:

“ComReg shall, in the exercise of its functions, take into account the national objective regarding broadband rollout, viz, the Government wishes to ensure the widespread availability of open-access, affordable, always-on broadband infrastructure and services for businesses and citizens on a balanced regional basis within three years, on the basis of utilisation of a range of existing and emerging technologies and broadband speeds appropriate to specific categories of service and customers.”

A 6.244 The purpose of this Policy Direction was to ensure that the regulatory framework for electronic communications plays its part in contributing to the achievement of the Government’s objectives regarding the rollout of broadband networks.

A 6.245 ComReg is cognisant of the fact that the three year objective described in this policy direction has now expired. In any case, ComReg is of the view that the Overall Preferred Option is aligned with the objectives of the Programme for Government. For example, it would promote the introduction of advanced WBB services in the selected bands at the earliest possible date and it complements other schemes such as the Mobile Broadband Taskforce aimed at improving broadband infrastructure and services for businesses and citizens.

A 6.246 In addition, the Overall Preferred Option should result in a greater competitive tension than in the case of an administrative assignment, and it can be expected to positively impact on downstream retail competition in the deployment, or augmented deployment, of enhanced services in terms

of bandwidth.

A 6.247 Furthermore, ComReg considers it unlikely that some form of administrative assignment of spectrum in the place of a competitive award procedure would incentivise the roll out of broadband infrastructure by recipients to the same extent as the Overall Preferred Option, if at all.

Policy Direction No.4 of 21 February 2003 on Industry Sustainability

A 6.248 This Policy Direction provides that:

“ComReg shall ensure that in making regulatory decisions in relation to the electronic communications market, it takes account of the state of the industry and in particular the industry’s position in the business cycle and the impact of such decisions on the sustainability of the business of undertakings affected.”

A 6.249 The purpose of this policy direction is to ensure that any regulatory decisions take due account of the potential impact on the sustainability of industry players, in particular in light of the business cycle at the time such decisions are taken.

A 6.250 ComReg observes that this policy direction concerns the sustainability of the industry as a whole rather than just the position of individual players. Notwithstanding, in its draft RIAs above, ComReg has considered the impact of its award proposals in the context of all industry stakeholders, including different types of industry stakeholders. ComReg considers that an open auction which facilitates greater participation on a non-discriminatory basis facilitates the sustainability of the industry as a whole.

A 6.251 This Policy Direction is clearly relevant in terms of those costs that industry must bear which are, to some extent, within the control of ComReg, for example, the nature and extent of any minimum prices in the Proposed Award and the related issue of the duration of spectrum rights of use. ComReg has had regard to this policy direction in devising its proposals in relation to licence duration and minimum prices.

Policy Direction No.11 of 21 February 2003 on the Management of the Radio Frequency Spectrum

A 6.252 This Policy Direction provides that:

“ComReg shall ensure that, in its management of the radio frequency spectrum, it takes account of the interests of all users of the radio frequency spectrum.”

A 6.253 The purpose of this policy direction is to ensure that ComReg achieves an

appropriate balance between the interests of various users of the radio frequency spectrum, in particular, the respective interests of commercial and non-commercial users.

A 6.254 In carrying out the above draft RIAs, ComReg has considered the Overall Preferred Option in light of the interests of various categories of industry stakeholders and consumers.

A 6.255 ComReg is of the view, therefore, that it has complied with this requirement in carrying out the above draft RIAs and that the Overall Preferred Option is the one that best serves the interests of all users of the radio frequency spectrum and strikes an appropriate balance where those interests may conflict.

General guiding principles (in terms of spectrum management, licence conditions and setting of licence fees)

A 6.256 ComReg notes that it is required to comply with the guiding principles of objectivity, transparency, non-discrimination and proportionality in carrying out its functions under the 2002 Act and the Common Regulatory Framework. In relation to the current process, ComReg considers that these principles are most relevant in terms of its functions concerning spectrum use and management, attaching conditions to rights of use and the setting of licence fees.

A 6.257 In relation to spectrum management and use, ComReg notes that:

- Regulation 11(2) of the Authorisation Regulations requires that ComReg grants rights of use for radio frequencies on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate; and
- the regulatory principle set out in Regulation 16(2) of the Framework Regulations requires ComReg in pursuing its objectives to apply objective, transparent, non-discriminatory and proportionate regulatory principles by, amongst other things, ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services.

A 6.258 ComReg notes that the above guiding principles are Irish and EU law principles that ComReg abides by generally in carrying out its day to day regulatory functions.

A 6.259 ComReg is of the view, having regard to the applicable legislation and legal

principles, its draft RIAs and other analyses, its expert advice and reports, and the other material to which it has had regard, that the Overall Preferred Option is objectively justified, transparent, non-discriminatory and proportionate.

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Annex: 7 Aligning existing spectrum rights of use in the 2.1 GHz Band

A7.1 Background

A 7.1 In section 5.4 of Document 19/59R, ComReg proposed that Three should be provided the option of applying for interim rights of use to effectively prolong its existing 2.1 GHz rights of use (comprised of “Licence A” and “Licence B”) so that they expire at the same time as Vodafone’s 2.1 GHz licence (i.e. 15 October 2022). ComReg set out detailed proposals for this approach in Annex 5 of Document 19/59R.

A 7.2 This annex is structured as follows:

- a summary of ComReg’s proposals in Annex 5 of Document 19/59R;
- a summary of responses received relating to those proposals;
- ComReg’s assessment of those responses; and
- in light of the above, ComReg’s preliminary decision on this aspect of the Proposed Award.

A7.2 Summary of ComReg’s proposals in Annex 5 of Document 19/59R

A 7.3 In summary, ComReg proposed to:

- upon receipt of an appropriate application from Three, grant it interim 2.1 GHz rights of use - comprised of the frequencies in its existing “A Licence” – which would commence on 25 July 2022 and fully expire on 15 October 2022 (Interim 2.1 GHz A Licence);
- upon receipt of an appropriate application from Three, grant it interim 2.1 GHz rights of use - comprised of the frequencies in its existing “B Licence” – which would commence on 2 October 2022 and fully expire on 15 October 2022 (Interim 2.1 GHz B Licence);
- attach conditions to both the Interim 2.1 GHz A and B licences by reference to the current licence conditions in each of the existing “A Licence” and “B Licence”, respectively, save for the removal of any obsolete conditions; and

- base the licence fees for each of the Interim 2.1 GHz A and B licences by reference to the licence fees for Vodafone's and Eir's existing 2.1 GHz licences, but updated to current day levels by reference to the overall consumer price index ("CPI").

A 7.4 In addition, ComReg stated, in paragraphs A 5.33 and A 5.34 of Document 19/59R, the following in relation to its proposed spectrum fees:

"A 5.33 In light of ComReg's obligations regarding promoting regulatory predictability, ensuring no distortions to competition and, further, in similar circumstances ensuring no discrimination in the treatment of undertakings providing ECS, ComReg proposes that:

- i. the fees for each of the Interim 2.1 GHz A and B licences would be set by reference to the spectrum fees (both SAFs and SUFS) for Vodafone's and Eir's existing 2.1 GHz licences; and*
- ii. these fees be updated to current day levels by reference to the overall CPI to account for the change in prices of goods and services since grant of the existing A and B licences in 2002.*

"A.54 This proposal also reflects the following factors:

- *the proposed interim licences would comprise new rights of use rather than an extension of existing rights;*
- *these additional rights of use are of economic value, the determination of which is required to be made in the context of the Common Regulatory Framework which requires inter alia objective, non-discriminatory and transparent treatment in the award of rights to radio spectrum, taking into account the need to maximise benefits to users, ensure optimum utilisation of scarce resources and facilitate the development of competition;*
- *in the present case, no "market value" can be determined for these additional rights of use since there are no unassigned 2.1 GHz rights which could be awarded and used as a reference;*
- *therefore the fees payable for the interim licences should approximate to fees already payable by direct competitors;*
- *Vodafone and Eir are the relevant comparators in the present case as both are actual direct competitors in the relevant mobile markets and the other 2.1 GHz FDD licensees; and*
- *the proposed interim licences would provide Three additional periods beyond the 20 year licence duration of all existing 2.1*

GHz FDD licences by which to continue to provide 3G mobile services and said additional periods would not in any event be available to Vodafone and Eir, given the intended purpose of the interim licensing proposal and the different factual circumstances.”

A7.3 Summary of views of respondents to Annex 5 of Document 19/59R

A 7.5 ComReg received views from two respondents with regard to its detailed proposals (Eir and Three).

A 7.6 In summary, eir supported ComReg's proposals “...*subject to the terms and conditions, including payment of appropriate fees, as set out in Annex 5 of Document 19/59.*” In eir's view, “[t]his is necessary to reduce the distortionary effect of introducing time-slices. Ideally steps should be taken to eliminate the need for time-slices.”

A 7.7 In relation to Three's submission, ComReg firstly notes that Three “...*accepts that it would be desirable to common [sic] expiry dates for the 12 lots licensed to Three and Vodafone*” and that:

“We will assist ComReg in making the award simpler, and we agree that having multiple different expiry dates is not desirable, however this proposal would penalise Three by imposing inappropriate fees for licence extensions that are designed to facilitate the award process. This solution might be acceptable if appropriate extension fees were applied.”

A 7.8 In relation to ComReg's proposals regarding the appropriate spectrum fees for any Interim 2.1 GHz A Licence and Interim 2.1 GHz B Licence, Three made various assertions including that:

- a) the proposed licence fees are “*excessive*”, “*inappropriate and without rationale*”;
- b) “*3G licences were awarded under different circumstances than exist today, and valuations in 2002 were completely different to those that apply now.*”;
- c) “*..two different licence types were issued in 2002, the “A” licence and the “B” licence. Different conditions are contained in both licences (and it would not be a simple task to quantify these differences), and different spectrum access fees were applied also.*”;
- d) “*As the spectrum access fees have already been fully paid for the two licences, this should not be applied again when the purpose of*

the extension is to facilitate continuity of service while simplifying ComReg's re-award."

- e) *"There is no logical reason why ComReg would seek to link the price for extension of Three's "A" licence to that of the "B" licence awarded to Vodafone in 2002 or Eir in 2007.";*
- f) *"The proposal to increase those licence fees by the change in CPI since 2002 is also without logical explanation.";*
- g) *"ComReg is well aware that the market value for award of liberalised spectrum today is significantly lower than for 3G service in 2002. ComReg's own estimate of the current market value for a 15 year licence is between €0.197 and €0.234 per MHz/pop, whereas ComReg is proposing to impose a fee for the licence extension that is multiples of this."*
- h) *"It is notable that ComReg does not propose to amend the licence conditions (save for the removal of any obsolete conditions) with the exception of the price.";* and
- i) *"ComReg's proposal for 3G licence extension fees stands in contrast with the proposal to liberalise Eir's 3G licence up to 2027, which will be for free unless the value for 2.1GHz in the award exceeds the original licence fee. ComReg's approach does not represent equivalent treatment to Eir in largely comparable circumstances."*

A 7.9 ComReg also notes the following views expressed by Three regarding ComReg's proposals to liberalise existing 2.1 GHz rights of use (which are relevant to the present discussion):

- a) There is *"no reliable method to derive the appropriate fee [for liberalisation] for this period [i.e. up until 2022]."*; and
- b) *"If Eir is now to be given an option to "liberalise" that licence, and if Eir takes up that option, then there must be some additional value to having the licence liberalised – otherwise eir would choose not to accept the amendment."*

A7.4 ComReg's assessment

A 7.10 ComReg is grateful for the views received and outlines its assessment of same below.

A 7.11 ComReg firstly notes Eir's support for the interim licensing proposals.

A 7.12 ComReg also notes and welcomes Three's acceptance of the desirability of establishing a common expiry of Vodafone's and Three's 2.1 GHz licences.

A 7.13 In relation to Three's points (a), (b), (c), (d), (e) and (f) above:

- ComReg sets out key factors informing the rationale for its fee proposal at paragraphs A 5.33 and A 5.34 of Annex 5 of Document 19/59R. Accordingly, it cannot accept that those proposals are “without rationale”.
- ComReg notes that Three does not advance any coherent argument to counter the factors set out in paragraph A5.34 of Document 19/59R.
- For the avoidance of doubt, ComReg considers that Three's points (a)-(f), both individually and overall, are clearly and satisfactorily addressed by the factors set out in paragraph A5.34 of Document 19/59R.
- In particular, those factors inform ComReg's view as to why spectrum fees should be charged for these additional licence periods and, further, why such fees should be referenced to the current fees of Eir, and Vodafone in particular.⁴⁹¹

A 7.14 Given this, ComReg does not find Three's arguments regarding ComReg's spectrum fee proposals persuasive.

A 7.15 Additionally, ComReg notes that it previously proposed the grant of short-term interim GSM 1800 MHz interim rights to Telefonica O2 (which Three subsequently acquired by way of the 2014 Merger). As Three will recall, ComReg's interim spectrum fee proposal in that matter entailed applying the then existing GSM 1800 MHz fees and the updating of same to then present-day prices by reference to CPI.⁴⁹² Three supported that proposal at the time.

⁴⁹¹ Also noting:

- the general principle that equivalent charges should be applied to competing operators for the use of scarce resources whose values appear to be 'equivalent in economic terms'; in this case “unliberalised” 2.1 GHz rights of use; and
- that the general fee system for 3G operators has been in place since 2002 and remains applicable to both Vodafone and Eir. As such, it is appropriate to use that same fee system for the interim licences which ComReg proposes to grant to Three. i.e. based upon the existing fees for 3G licences, but updated to current day values.

⁴⁹² See ComReg Document 14/121 and Three's non-confidential submission at Annex 3 to same. ComReg also recalls Three's submissions regarding the proposed grant of interim GSM 900 MHz licences to Vodafone and Telefonica O2 in 2011 where Three, among other things, claimed that the application of indexation to the then existing GSM spectrum fees to be insufficient in those circumstances. For example:

“ComReg is proposing to grant new licences to Vodafone and O2, which are clearly known (from Vodafone and O2's publicly available figures) to generate vast profits and which require no significant capital investment, at only a slightly higher spectrum usage fee to that applied in 1996.” (emphasis added).

A 7.16 More generally, ComReg observes that the application of indexation of licence fees would be consistent with its approaches to the grant of both interim 900 MHz and 1800 MHz licences, thereby promoting regulatory certainty, and its statutory objectives/duties in relation to spectrum fees (including ensuring that fees encourage the optimal use of spectrum rights).

A 7.17 In relation to Three's claim at point (g), ComReg responds as follows:

- ComReg observes that the figures cited are merely *estimates* of current prices, based on benchmark figures;
- ComReg also recalls that actual prices in the 2012 MBSA and 3.6 GHz Band Award were significantly in excess of the reserve prices;
- more importantly, and as ComReg identified in para A 5.35 of Document 19/59R, there does not exist a market mechanism by which to determine current prices as there are no unassigned rights of use during the relevant time period by which to determine what the market price of the additional periods would be;
- indeed, ComReg notes that Three's view at point (g) does not sit squarely with its view at point (k) that there is "*no reliable method to derive the appropriate fee [for liberalisation] for this period [i.e. up until 2022].*" That is, whereas Three appears to be claiming that ComReg's benchmark figures are sufficiently robust by which to support a lower spectrum fee for any 2.1 GHz interim rights of use it might be granted on foot of ComReg's proposal, it also appears to be of the view, in the same matter and for the same time period, that there is "*no reliable method to derive the appropriate fee for liberalisation during the period until 15 October 2022*" (which presumably is the difference between the price of liberalised 2.1 GHz rights (currently unknown) and unliberalised 2.1 GHz spectrum rights (known)); and
- accordingly, ComReg does not consider this claim persuasive.

A 7.18 In relation to point (h) concerning ComReg not proposing to amend any other licence conditions, ComReg observes that there does not appear to be any reason to do so (save for the removal of any obsolete conditions) given the stated intention of interim licensing proposal (i.e. as a facilitating measure). Having reviewed the licences, ComReg does not propose to delete any licence conditions. That said, it would be open to all Licensees to apply for early liberalisation.

A 7.19 In relation to point (i) regarding Three's claimed variance in treatment of it

and Eir, ComReg would highlight the following:

- first, there are clearly materially different objectives and rationales underlying the two proposals (see the relevant sections of Document 19/59R);
- that being said, ComReg notes that the fee aspects of both proposals are informed by similar considerations under the Common Regulatory Framework (and State Aids) including, in particular:
 - ComReg's general obligations regarding fees for rights of use of radio frequencies (per Regulation 19 of the Authorisation Regulations);
 - ComReg's objective to promote competition, including ensuring that there is no distortion or restriction of competition in the electronic communications sector;
 - the general principle that equivalent charges should be applied to competing operators for the use of scarce resources whose values appear to be 'equivalent in economic terms'; and
- in light of the above, ComReg is of the view that it is appropriate that:
 - the proposed fees for Interim 2.1 GHz A and B Licences are being set by reference to the fees being paid by the other existing unliberalised 2.1 GHz licensees (i.e. Vodafone and Eir) during same time period;
 - no fees are proposed to be charged for any 2.1 GHz licensee who requests the liberalisation of their licence up to 15 October 2022; and
 - additional fees may be required to be paid by Eir (if it requests the liberalisation of its 2.1 GHz licence) for the period 16 October until 11 March 2027 by reference to the methodology proposed by ComReg to determine prices paid by winning bidders of liberalised rights in the same time period (i.e. Time Slice 1). For the avoidance of doubt, as Three does not currently hold liberalised 2.1 GHz rights in Time Slice 1, ComReg does not accept Three's claim of non-equivalent treatment "*in largely comparable circumstances*".

A7.5 ComReg's preliminary decision

A 7.20 In light of the above, ComReg has formed the preliminary decision to:

- upon receipt of an appropriate application from Three, grant it interim 2.1 GHz rights of use - comprised of the frequencies in its existing “A Licence” – which would commence on 25 July 2022 and fully expire on 15 October 2022 (Interim 2.1 GHz A Licence);
- upon receipt of an appropriate application from Three, grant it interim 2.1 GHz rights of use - comprised of the frequencies in its existing “B Licence” – which would commence on 2 October 2022 and fully expire on 15 October 2022 (Interim 2.1 GHz B Licence);
- attach conditions to both the Interim 2.1 GHz A and B licences by reference to the current licence conditions in each of the existing “A Licence” and “B Licence”, respectively; and
- calculate the licence fees for each of the Interim 2.1 GHz A and B licences by reference to the licence fees for Vodafone’s and Eir’s existing 2.1 GHz licences, but updated to current day levels by reference to the overall CPI. In that regard, ComReg proposes to calculate the overall CPI change using the latest CPI data available at the time at which it would be making the proposed licensing regulations under the Wireless Telegraphy Act (a draft of which is currently envisaged to be made available for comment alongside the draft information memorandum).

A 7.21 This preliminary decision is subject to the matters described in section 4.4.5 of this document.

Annex: 8 Draft 2.1 GHz Band Liberalisation RIA

Introduction

- A 8.1 In Annex 6 of Document 19/59R ComReg set out a draft RIA on the options regarding the liberalisation prior to the expiry of the existing 2.1 GHz rights of use, which are currently not liberalised and which expire in 2022 (Three and Vodafone) and 2027 (Eir).
- A 8.2 This Annex sets out a further draft of the RIA in Annex 6 of Document 19/59R, amended in light of comments received in response to that document and market developments since that time. Accordingly, much of the text of this Annex is unchanged from Annex 6 of Document 19/59R.

RIA Framework

- A 8.3 The purpose, structure and scope of the RIA framework is discussed at the commencement of the draft 'Spectrum for Award' RIA which is set out in Annex 6 and is not repeated here.

Background

- A 8.4 By way of background, ComReg sets out some information on the following which are relevant to the assessment provided in this draft RIA.
1. European Commission Decision 2012/688/EU;
 2. ComReg's preliminary consultation on the liberalisation of the paired terrestrial 2 GHz spectrum band (Document 14/65)⁴⁹³;
 3. market developments since 2014; and
 4. technical benefits of liberalisation.

European Commission Decision 2012/688/EU

- A 8.5 In November 2012, the European Commission (EC) adopted a decision on the harmonisation of the frequency bands 1920-1980 MHz and 2110-2170 MHz (i.e. 2.1 GHz Band) for terrestrial systems capable of providing

⁴⁹³<https://www.comreg.ie/publication/preliminary-consultation-liberalisation-of-the-paired-terrestrial-2-ghz-spectrum-band/>

electronic communications services in the Union (Decision 2012/688/EU).

- A 8.6 Among other things, Decision 2012/688/EU requires Member States to “*designate and make available, on a non-exclusive basis, the paired terrestrial 2 GHz band for terrestrial systems capable of providing electronic communications services, in compliance with the parameters set out in the Annex*” to that decision.⁴⁹⁴
- A 8.7 The technical conditions set out in the Annex to Decision 2012/688/EU are derived from CEPT Report 39⁴⁹⁵ and are presented in the form of frequency arrangements⁴⁹⁶ for the band and Block Edge Masks⁴⁹⁷ for base stations and terminal stations⁴⁹⁸.
- A 8.8 These technical conditions are technology-neutral and allow technologies other than the UMTS technology to be deployed in the 2.1 GHz Band (e.g. LTE).

Preliminary Consultation Document 14/65

- A 8.9 In Document 14/65⁴⁹⁹, ComReg sought views from interested parties on the implementation of Decision 2012/688/EU in Ireland (i.e. “liberalisation”) in the context of ComReg’s statutory functions, objectives and duties in relation to the radio frequency spectrum.
- A 8.10 ComReg sought views on the potential impact of such liberalisation particularly in terms of:
- the benefits to consumers in terms of furthering their interests by, for example, encouraging innovation, investment, and the availability and use of mobile services in Ireland; and result in better choice, price, quality of service and value for money; and/or
 - whether liberalisation might give rise to a material risk of a distortion of competition to the detriment of consumers such that any benefits

⁴⁹⁴ Article 2(1) of Decision 2012/688/EU/

⁴⁹⁵ <http://www.erodocdb.dk/Docs/doc98/official/pdf/CEPTREP039.PDF>

⁴⁹⁶ Frequency arrangements refer to the band plan and duplex mode of operation.

⁴⁹⁷ A Block-Edge Mask (BEM) “*is an emission mask that is defined, as a function of frequency, relative to the edge of a block of spectrum for which rights of use are granted to an operator. It consists of in-block and out-of-block components which specify the permitted emission levels over frequencies inside and outside the licensed block of spectrum, respectively.*” (Source Annex to Decision 2012/688/EU)

⁴⁹⁸ In Decision 2012/688/EU the BEM for the terminal station consists only of an in-block component.

⁴⁹⁹ <https://www.comreg.ie/publication/preliminary-consultation-liberalisation-of-the-paired-terrestrial-2-ghz-spectrum-band/>

resulting from liberalisation would be outweighed by the detriment to consumers resulting from any such a distortion of competition.

A 8.11 ComReg received three responses⁵⁰⁰ to Document 14/65. ComReg referred to these responses in Document 19/59R and again in formulating its views on stakeholders likely views on each of the regulatory options.⁵⁰¹ Operators have since provided updated views in response to Document 19/59R and ComReg considers that these more recent responses are likely to better reflect the current views of stakeholders. In that regard, ComReg addresses the specific issues raised by respondents on the draft '2.1 GHz Band Liberalisation' RIA in Chapter 4. However, the 'Impact on Stakeholders' section below has been updated to take account for these more recent views.

Market developments since 2014

A 8.12 In this section, ComReg briefly discusses certain developments since Document 14/65 that are likely to be relevant to the assessment that follows in this draft RIA. In particular, these developments are likely to provide information on the extent to which competitive distortions might occur over the period set out in the regulatory options below.

LTE rollout

A 8.13 All MNOs have now launched LTE but in bands other than the 2.1 GHz Band and coverage is widespread across the country. For example, a European Commission study on broadband coverage in Europe published in October 2019 found that 96% of the homes in Ireland had LTE coverage⁵⁰² and this is illustrated in ComReg's outdoor mobile coverage map.⁵⁰³

A 8.14 This has resulted in a large increase in the number of 4G subscribers. For example, between Q3 2014 and Q3 2019, the proportion of 3G subscriptions has fallen from 69% to 33% while the proportion of 4G subscriptions has increased from 9% to 60% over the same period.⁵⁰⁴

3.6 GHz Award

A 8.15 The 3.6 GHz Award resulted in the successful assignment of all 350 MHz of spectrum available to five winning bidders and services are beginning to

⁵⁰⁰ ComReg intends to publish the responses shortly on its website

⁵⁰¹ Summaries of these views are provided in Document 19/59R.

⁵⁰² <https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2018>

⁵⁰³ <https://www.comreg.ie/outdoor-mobile-coverage-map/>

⁵⁰⁴ ComReg Quarterly Reports.

be rolled out across the country.⁵⁰⁵ This award has significantly reduced spectrum asymmetry between MNOs:

- Prior to the 3.6 GHz Award (and at the time of Document 14/65):
 - the spectrum asymmetry between Eir and Three was **80 MHz and 20%** of total spectrum holdings.
 - the spectrum asymmetry between Vodafone and Three was **60 MHz and 15%** of total spectrum holdings.
- Following the 3.6 GHz Award and the assignment of 290 MHz between MNOs:
 - the spectrum asymmetry between Eir and Three was **105 MHz and 14%** of total spectrum holdings.
 - the spectrum asymmetry between Vodafone and Three was **55 MHz and 8%** of total spectrum holdings.

Market shares

A 8.16 The market share of the three MNOs have been relatively static over the period since the merger (Q2' 2014 – Q3' 2019), although Eir has reduced its market share somewhat (subscribers).⁵⁰⁶ For example⁵⁰⁷:

- Vodafone's market share remains at around 39% in Q3 2019 and it has added 312,257 subscribers.
- Three's market share remains at around 36% and it has added 262,768 subscribers.
- Eir's market share has fallen from 18.3% in Q2 2014 to 15.6% in Q3 2019 and it has lost 33,927 subscribers.

Additional rights of use

A 8.17 ComReg notes that proposals to assign additional liberalised rights of use have significantly progressed with this Proposed Award due to take place in 2020. An additional 350 MHz of liberalised rights of use is proposed to be released (including 2.3 GHz and 2.6 GHz Bands, which are likely to become more substitutable to the 2.1 GHz Band in the medium to long term, substitutable to the 2.1 GHz Band). This follows the 350 MHz already released in the 2017 3.6 GHz Award.

⁵⁰⁵ <https://www.comreg.ie/industry/radio-spectrum/spectrum-awards/3-6ghz-band-spectrum-award/>

⁵⁰⁶ Tesco gained over 2% (Q2 2014 – Q3 2019).

⁵⁰⁷ ComReg Quarterly Reports (Q2'14 – Q3'19).

Technical benefits of liberalisation

A 8.18 ComReg notes that any distortions to competition that may arise would be related to the particular benefits that could be obtained from liberalisation. By allowing the deployment of technologies other than UMTS (and LTE in particular), liberalisation should provide a number of technical benefits that would result in (a) higher speeds and (b) increased capacity.

- **In relation to (a)**, higher peak data rates and user throughput is primarily the result of wider channel bandwidths and carrier aggregation. This allows operators to provide higher speed services. For example:
 - The peak data rate for HSDPA (Release 7) is 14.4 Mbit/s, with a peak user data rate of 13.4 Mbit/s.⁵⁰⁸
 - The peak data rate for LTE Advanced (Release 10) is 3 Gbps (DL) and 1.5 Gbps (UL).⁵⁰⁹
- **In relation to (b)**, improved spectrum efficiency provides greater capacity in a cell. Spectral efficiency is a good indicator of the capacity of a particular technology and the ability of operators to deliver additional capacity at a site. This allows operators to increase capacity and reduce or eliminate capacity constraints in certain areas. For example:
 - A maximum spectral efficiency of 30 bit/s/Hz for LTE Advanced (Release 10).⁵¹⁰
 - A maximum spectral efficiency of 4.5 bit/s/Hz for HSDPA (Release 7).⁵¹¹

Identify the policy issues and identify the objectives (Step 1)

Policy issues

A 8.19 The primary policy issue is to determine whether and, if so, when existing rights of use in the 2.1 GHz Band should be liberalised to enable the deployment of technologies compatible with the technical conditions set out in Decision 2012/688/EC, in the context of ComReg's statutory functions, objectives and duties in relation to the radio frequency spectrum.

⁵⁰⁸ <http://www.3gpp.org/technologies/keywords-acronyms/99-hspa>

⁵⁰⁹ <http://www.3gpp.org/technologies/keywords-acronyms/97-lte-advanced>

⁵¹⁰ 3GPP TR 36.913 V10.0.0 (2011-03) Technical Report. P9.

⁵¹¹ ftp://www.3gpp.org/tsg_ran/WG1_RL1/...20/.../R1-01-0471.pdf

Objectives

A 8.20 The focus of this draft RIA is to assess the impact of the proposed measure(s) (see regulatory options below) on industry stakeholders, and on competition and consumers. In that way, it allows ComReg to identify and implement the most appropriate and effective means to assign spectrum rights of use, while still allowing ComReg to achieve its objectives of:

- liberalisation of the 2.1 GHz Band for terrestrial systems capable of providing ECS, in compliance with the parameters set out in 2.1 GHz Decision;
- assigning liberalised rights of use in the 2.1 GHz Band with other complementary and substitutable bands in the Proposed Award (e.g. 700 MHz Duplex, 2.3 GHz Band and 2.6 GHz Band);
- promoting competition and ensuring that there would be no distortion or restriction of competition in the electronic communications sector by, amongst other things:
 - ensuring that users derive maximum benefit in terms of choice, price and quality;
 - ensuring that there is no distortion or restriction of competition in the electronic communications sector;
 - encouraging efficient use and ensuring effective management of radio frequencies;
- encouraging efficient investment in infrastructure, promoting innovation and ensuring the efficient use and effective management of the radio frequency spectrum; and
- promoting the interest of economic development of the State and electronic communications sector.

A 8.21 ComReg's other overarching objectives are to contribute to the development of the internal market and to promote the interests of users within the Community. ComReg also notes that, in achieving its objectives, its ultimate aim is to choose regulatory measures which maximise the benefits for consumers in terms of price, choice and quality.

Identifying the regulatory options

A 8.22 The two broad options available are to liberalise, or not, some or all existing 2.1 GHz rights of use. In relation to the timing of any such liberalisation, ComReg is of the view that the earliest time at which such liberalisation

could reasonably be provided for would be around the time of the substantive decisions concerning the proposed award of a limited number of individual rights of use in the proposed frequency bands. This view is informed by a number of factors, including that:

- any decision to liberalise existing rights of use in the 2.1 GHz Band (by way of licence amendment) is subject to consultation and response to same which could take up to 1 year;
- the potential for distortions to competition from any liberalisation would reduce as one gets closer to the time of the Proposed Award; and
- the views of DotEcon that it may be preferable to wait until at least the point at which substantive decisions have been made regarding this award and the liberalisation process, to ensure that all operators will have reasonable clarity in advance over the terms of liberalising their own licences.⁵¹²

A 8.23 In light of the above, three regulatory options appear to be available:

- **Option 1:** Do not liberalise any 2.1 GHz rights of use prior to expiry of same⁵¹³;
- **Option 2A:** Provide the option for all existing licensees to liberalise some or all existing 2.1 GHz rights of use from the time of the substantive decisions concerning the present Proposed Award; and
- **Option 2B:** Provide the option for all existing licensees to liberalise some or all existing 2.1 GHz rights of use following the assignment of new rights of use in the proposed frequency bands in the Proposed Award.

A 8.24 ComReg notes that under Option 2A and 2B the licensee would retain full discretion on when to liberalise existing 2.1 GHz rights of use. The difference between Option 2A and 2B concerns when the option to liberalise would be made available to all licensees.

A 8.25 In relation to Options 2A and 2B, ComReg considers whether a material distortion to competition would be likely to arise from the liberalisation of all 2.1 GHz rights of use. ComReg only considers it necessary to assess

⁵¹² DotEcon Award Design Report (Document 19/59a), p20.

⁵¹³ The various licence expiries are set out below.

- Three's rights of use in its "A licence" expire on 24 July 2022, and its "B Licence" expire 1 October 2022;
- Vodafone's rights of use expire 15 October 2022; and
- Eir's rights of use expire 11 March 2027;

whether to liberalise a portion of an existing licensee's rights of use (i.e. 2x15 MHz each as suggested by Eir) if a material distortion to competition would be likely to arise from liberalising all rights of use.

A 8.26 Further, ComReg notes that a relevant consideration in determining the preferences of stakeholders relates to whether liberalisation fees should apply and, if so, how and when such fees should be calculated. In that regard, Chapter 5 of Document 19/59R sets out ComReg's views on the liberalisation fees that would apply in the event of liberalisation being the preferred option. In summary, ComReg is of the preliminary view that:

- for the period up until 15 October 2022 it would not be appropriate to apply fees for the early liberalisation of licences; and
- while liberalisation fees are unlikely to be required for Eir for the period 16 October 2022 – 11 March 2027, it would be prudent nonetheless to have in place a process that would apply appropriate liberalisation fees, if in the unlikely event, the new 2.1 GHz liberalised rights of use fees were higher than fees currently being paid by Eir for unliberalised rights of use.

A 8.27 Finally, ComReg notes the following assumptions are relevant to the timing of Option 2A and Options 2B:

- ComReg's proposal to align the expiry of Vodafone's and Three's existing rights to October 2022⁵¹⁴;
- Any liberalised existing rights of use would be available to Three and Vodafone until October 2022 and until October 2027 for Eir;
- ComReg's substantive decisions on the Proposed Award would be made in 2020; and
- The time between ComReg's substantive decisions on the Proposed Award and the commencement date of any new rights of use granted on foot of the Proposed Award would be circa 6-12 months (noting that this period was around 9 months in the 2012 MBSA).

Identification of stakeholders

A 8.28 Stakeholders consist of two main groups:

⁵¹⁴ See Annex 5.

- consumers (for the purposes of this draft RIA, consumers include both business and residential consumers), and
- industry stakeholders.

A 8.29 There are a number of key industry stakeholders in relation to the matters considered in this Annex:

- existing MNOs who have spectrum rights of use in the 2.1 GHz Band⁵¹⁵); and
- MVNOs.

Impact on stakeholders

Option 1

A 8.30 MNOs are unlikely to prefer Option 1 as they would continue to be prevented from deploying and using technologies compatible with the technical conditions in Decision 2112/688/EU in the 2.1 GHz Band (such as LTE). As noted by DotEcon⁵¹⁶, in addition to significant benefits for consumers, liberalisation may bring about potential cost savings for operators by facilitating transition to more spectrally efficient technologies. All MNOs have expressed a preference for liberalisation (in response to both Document 14/85 and Document 19/59R) and the increased demand for data-intensive services (e.g. see draft 'Spectrum for Award' RIA) means that liberalisation, even for a short period of time prior to expiry of existing licences could be beneficial to MNOs.

A 8.31 Under Option 1, MNOs would have to delay providing LTE services in the 2.1 GHz Band until the expiry of existing licences. This poses a number of difficulties, including that:

- for Vodafone and Three, the rollout of LTE 2100 would be delayed until the commencement of new rights of use in the 2.1 GHz Band in 2022 (i.e. Time Slice 1), which would be 1 - 2 years after the proposed assignment of rights of use in the 2.3 GHz Band and 2.6 GHz Band;
- there is the potential for inefficient rollout if operators would have preferred to use 2.1 GHz rights of use but instead had to use alternative liberalised rights of use (e.g. 2.3 GHz and 2.6 GHz instead)

⁵¹⁵ Eir, Three and Vodafone.

⁵¹⁶ DotEcon award Design Report, p19

because liberalised 2.1 GHz rights of use were unavailable due to a licence condition;

- Eir would either have to wait until 2027 (until its existing rights of use expired) or obtain new 2.1 GHz rights from 2022, which may be inefficient if it did not need its entire existing spectrum rights to support UMTS services (i.e. could have made use of some or all of its existing rights for the provision of LTE services); and
- some or all operators may already be capacity constrained in certain areas and liberalisation at the earliest opportunity would allow it to remedy some of these concerns prior to the assignment of additional rights of use in the Proposed Award.

A 8.32 Similarly, other industry stakeholders, such as MVNOs, would likely prefer liberalisation as it would provide additional LTE services to its customers.

A 8.33 Consumers would likely prefer liberalisation as it would provide additional LTE services to them.

A 8.34 Therefore, and in light of the responses to Document 19/59R, ComReg is of the preliminary view that stakeholders generally would be unlikely to prefer Option 1.

Option 2A v Option 2B

A 8.35 Whilst stakeholders would likely prefer liberalisation than not, they may have different views about the nature and timing of any such liberalisation.

A 8.36 Based on its response to Document 19/59A, Three would appear ostensibly at least to prefer Option 2B over Option 1 as this provides for liberalisation of licences before expiry.⁵¹⁷ However, given that Three has the largest 2.1 GHz holdings it seems more likely to prefer Option 2A over Option 2B as this would allow it to liberalise these holdings at the earliest opportunity.

A 8.37 In response to Document 19/59R, Vodafone noted that it would support liberalisation of the 2.1 GHz Band once dates for the proposed award were fixed.⁵¹⁸ ComReg notes that Option 2A provides for liberalisation before the award and the date of the award process would be available shortly

⁵¹⁷ This is also consistent with Three's stated views in response to Document 14/65 that ComReg should liberalise all 2.1 GHz rights of use with appropriate technical restrictions to avoid interference.

⁵¹⁸ Similarly, in response to Document 18/60 it submitted that it would be possible to construct an "early liberalisation option" to allow some or all the existing licensees the option to liberalise via the Proposed Award.

thereafter, although provisional dates would be available from the time of issue of the draft IM. Under Option 2B liberalisation would be delayed by circa 6 – 12 months.⁵¹⁹ Given such delays Vodafone may prefer to liberalise its rights of use at the earliest possible opportunity under Option 2A.

A 8.38 For example, Vodafone may be capacity constrained in particular areas and liberalised rights of use may be helpful in alleviating such constraints in the run up to the Proposed Award. In that regard, and in response to Document 19/59R, Vodafone contends that it has had capacity constraints arising from not having sufficient spectrum assigned. Further, it could also allow Vodafone to proceed with its rollout of LTE 2100 with the expectation that it would at least retain 2x15 MHz rights of use, unlike Three where its long term 2.1 GHz holdings are less certain due to its current 2.1 GHz holdings (2x30 MHz) being twice that of other MNO.

A 8.39 Alternatively, if all rights of use are to be liberalised Vodafone may prefer Option 2B over Option 2A as this would prevent Three potentially taking advantage of liberalisation between the time of the substantive decision and the Proposed Award. However, as noted below (Impact on Competition), the extent to which Three could take advantage of liberalised rights of use between the substantive decision and time of the award is likely to be very limited. Further, in response to Document 19/59R, Vodafone acknowledges that Three's ability to take advantage of any spectrum asymmetry could only arise in the medium to long-run given the ongoing merging of the Three and O2 networks. Given the short run considerations of this RIA, it would appear that Vodafone would likely prefer to liberalise its rights of use at the earliest possible opportunity under Option 2A.

A 8.40 Eir agrees there should be an early liberalisation option but does not agree with ComReg's preferred Option 2A. In Eir's view the timing of the exercise of the liberalisation rights could be better aligned to Option 2B. Eir's concerns in relation to timing are discussed in Chapter 4 wherein ComReg confirmed that the difference between Option 2A and 2B relates to when the option to liberalise would be available to licensees. Under both options the decision on when to apply for liberalisation would remain a matter for the licensee. In that regard, Eir would be free to liberalise at its discretion under Option 2A (or Option 2B) and it would not be required to do so at the time of the substantive decision.

A 8.41 In relation to the timing of any liberalisation as noted above there would be no liberalisation fees for the period 2020 – 2022. However, any fees for 2022 - 2027 (which would be applicable to Eir only) would depend on the

⁵¹⁹ ComReg assesses Vodafone's concerns in relation to the timing of the award in Section 4.4.

extent to which the prices achieved in the Proposed Award exceeded the current fees being paid by Eir⁵²⁰ (See above and Chapter 5 of Document 19/59R for further discussion). While DotEcon does not expect this situation to occur⁵²¹ there remains the possibility (albeit slim) that additional liberalisation fees may apply. Under Option 2A, any liberalisation by Eir would be in the knowledge that unspecified liberalisation fees may be payable for Time Slice One, post award.

A 8.42 While Eir is likely to prefer Option 2A over Option 1, it would have concerns regarding potential liberalisation fees and the potential impact on competition. While Eir would retain discretion on when to liberalise its 2.1 GHz holdings under either option, it would likely wait until the assignment of new rights of use in the proposed frequency bands in order to provide certainty over any liberalisation fees that might apply. In particular, under Option 2A, other operators would likely liberalise at the time of the substantive decision. Alternatively, under Option 2B, Eir would have full knowledge of any liberalisation fees that would apply, prior to a decision to liberalise 2.1 GHz rights of use while other operators⁵²² would not be permitted to liberalise sooner (i.e. taking advantage of liberalisation between the time of the substantive decision and the Proposed Award).

A 8.43 In that regard, ComReg is of the view that Eir would likely prefer Option 2B, however, it may be indifferent between Option 2A and Option 2B in light of the clarification provided by ComReg that the discretion of when liberalisation would occur would remain with the licensee and noting that Option 2A would provide it with the opportunity to liberalise earlier if it so wished.

Impact on competition

A 8.44 In Document 14/65, ComReg sought views on whether liberalisation would give rise to a material risk of a distortion of competition to the detriment of consumers such that any benefits resulting from liberalisation would be outweighed by the detriment to consumers resulting from any such a distortion of competition.

A 8.45 However, as outlined above, (see Policy Issues and Objectives) there are

⁵²⁰ As noted by DotEcon (Document 19/59a), it would be questionable to have a situation in which the Meteor licence is liberalised for 2020 – 2022 but then usage restrictions are reinstated from 2022 until the licence expires; this would go against the ECC Decision to make the 2.1 GHz spectrum available on a technology and service neutral basis.

⁵²¹ DotEcon notes that the value of the liberalised spectrum is likely to be less than the fees for the current 3G licences set in 2002/2007.

⁵²² For example, Eir has previously expressed concerns about the potential negative impacts of the spectrum asymmetry (between it and Three).

different elements to competition that are relevant in determining the impact of any of the preferred options. In that regard, ComReg considers the following to be particularly relevant in assessing the impact on competition across each option below:

- Ensuring that there is no restriction or distortion of competition in the electronic communications sector⁵²³;
- Safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure based competition⁵²⁴;
- Encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources⁵²⁵.
- Promoting efficient investment and innovation in new and enhanced infrastructures⁵²⁶; and
- Promoting competition during the award.

Option 1

A 8.46 Under Option 1, existing levels of competition would remain the same until the assignment of new rights of use in the Proposed Award. However, Option 1 could create distortions to competition in the future. In particular, and post award, it is likely that Option 1 would create a situation where different MNOs would have to compete on a different basis using the same spectrum (i.e. 2.1 GHz rights of use). For example, Eir would likely have unliberalised rights of use for the period up to the expiry of its existing licence in 2027. At the same time, Vodafone and Three could have been assigned liberalised rights of use in Time Slice 1 (up to 2027) and Time Slice 2 (up to expiry). While Eir could bid for new liberalised 2.1 GHz rights in Time Slice 1, this would not be an efficient use of the radio spectrum or an efficient investment and could create competition concerns during the award.

A 8.47 Under Option 1, infrastructure based competition would not be best promoted in the period between 2022 and 2027. Vodafone and Three would likely be able to roll out LTE 2100 on their networks using liberalised 2.1 GHz spectrum while Eir would be restricted to providing 3G mobile telephony services in the 2.1 GHz band until 2027. Further, over the same period operators are likely to commence migration away from 3G to 4G/5G

⁵²³ Section 12(2)(a) of the 2002 Act

⁵²⁴ Regulation 16(2) of the Framework Regulations

⁵²⁵ *ibid*

⁵²⁶ *ibid*

services (See the draft 'Spectrum for Award' RIA in Annex 6). While Eir could provide LTE services using existing and newly assigned rights of use in the Proposed Award, LTE 2100 could not be rolled out on its network. This would not contribute to users deriving maximum benefits in terms of choice, price and quality as Eir customers would not be provided with LTE services over the 2.1 GHz Band.

- A 8.48 Further, under Option 1, the rollout of LTE 2100 would be delayed for all MNOs until 2022 when new liberalised 2.1 GHz rights of use would become available (being 1 - 2 years after the proposed assignment of rights of the 2.6GHz and 2.3 GHz bands). This would not encourage the efficient use of the radio spectrum as a more efficient mobile technology (LTE) would be not be permitted due to a restriction of existing licence conditions, despite a likely preference for operators to rollout that technology.
- A 8.49 Such a situation would also increase the risk of inefficient investment and rollout as operators who would prefer to rollout LTE 2100 in certain areas would either have to wait until 2022 or use 2.6 GHz and/or 2.3 GHz which may be a less efficient way of achieving its desired network rollout. It would also shield any less efficient operators who currently would prefer the existing usage restrictions in order to delay other MNOs from expanding LTE 2100 services.
- A 8.50 Finally, given the later expiry of Eir's 2.1 GHz rights, Option 1 could create artificial competition in the Proposed Award if Eir was required to bid for new liberalised 2.1 GHz rights in Time Slice 1 when it could have otherwise met its demands for the rollout of LTE 2100 with its existing (but liberalised) rights of use. ComReg also observes that such a scenario would be unlikely to promote the efficient use of spectrum.
- A 8.51 In light of the above, ComReg is of the preliminary view that competition is unlikely to be best promoted under Option 1.

Option 2A v Option 2B

- A 8.52 Option 2A and Option 2B both involve the liberalisation of the 2.1 GHz Band. In that regard, DotEcon is of the view⁵²⁷ that there would appear to be clear potential benefits in liberalising the 2.1 GHz licences such that operators are able to use the frequencies on a service and technology neutral basis. It would provide operators with the opportunity to rollout LTE services using the 2.1 GHz Band up to two years (Vodafone and Three) and seven years (Eir) earlier than would otherwise have been the case. As noted by *DotEcon*, "Applying an early liberalisation option on the current 2.1 GHz

⁵²⁷ DotEcon Award Design Report, p39

*licences would mean that (where efficient), the spectrum could be used earlier for the provision of services other than UMTS. This may bring about significant benefit for consumers and potential cost savings for operators by facilitating transition to more spectral efficient technologies.”*⁵²⁸

A 8.53 This would allow all operators (if successful during award) to use 2.1 GHz rights of use without any restriction on what services could be rolled out.⁵²⁹ This should promote competition in downstream markets by increasing the availability of liberalised rights of use which allows all operators to provide more advanced services. This should contribute to users deriving maximum benefits in terms of choice, price and quality.

A 8.54 Both options would also have a positive impact on other elements of competition for the following reasons:

- infrastructure based competition would be better promoted as all MNOs would be able to roll out LTE 2100 on their networks at the same time;
- the rollout of LTE 2100 could begin no later than the availability of other liberalised rights of use (2.6 GHz and 2.3 GHz) promoting more efficient use of the radio spectrum and more efficient investment;
- any less efficient operators who currently prefer the existing usage restrictions would not be shielded from more efficient operators who wish to rollout LTE 2100 at the earliest opportunity; and
- competition during the award would be based on actual demand rather than some artificial demand as a result of the restriction on existing rights of use.

A 8.55 Therefore, Options 2A and 2B should, absent any other concerns, better promote competition than Option 1 by allowing MNOs to rollout LTE 2100 in the 2.1 GHz Band. In that regard, ComReg assesses the following:

- **First**, ComReg considers whether liberalisation of all 2.1 GHz rights of use would confer a material advantage on Three under Options 2A and Option 2B as it would have the option to liberalise an additional 2x15 MHz rights of use.
- **Second**, ComReg assesses whether liberalisation at the earliest possible opportunity (i.e. at the time of the substantive decision (Option 2A)) would create competition concerns such that liberalisation

⁵²⁸ Document 19/59a p 22.

⁵²⁹ Subject to complying with appropriate BEMs etc. to protect other licensees.

following the assignment of new rights of use in the proposed award would better promote competition.

1. Would the liberalisation of an additional 2x15 MHz confer a material advantage on Three?

- A 8.56 The main theory of harm associated with liberalisation appears to be that Three would be permitted to liberalise 2x30 MHz 2.1GHz rights of use, allowing it to obtain a material advantage that could not be efficiently/effectively replicated by Vodafone and/or Eir who would only have the option to liberalise 2x15 MHz 2.1GHz rights of use. In this regard, an important consideration is the extent to which the availability of an additional 2x15 MHz 2.1 GHz liberalised rights of use could create a material distortion to competition under Option 2A or Option 2B.
- A 8.57 ComReg notes that the technical benefits of liberalisation referred to above would be available to all MNOs. However, Three could theoretically be able to exploit these advantages more readily given the availability of an additional 2x15 MHz rights of use. For example, the liberalisation of 2.1 GHz would allow Three to deploy two 2x15 MHz LTE carriers in the 2.1 GHz Band. This could support higher user data speeds, improve capacity, and quality of service and potentially give it a headline speed advantage in the near term over both Eir and Vodafone. Alternatively, it could rollout LTE in part of the spectrum and maintain UMTS services using some of its 2.1 GHz spectrum, in a manner that would not be available to other operators.
- A 8.58 However, ComReg is of the preliminary view that Three is unlikely to be able to obtain a material advantage for a number of reasons.
- i. The time between the proposed award and expiry of Three's 2.1 GHz rights of use is narrow (i.e. circa 18 months).
 - ii. Vodafone and Eir would both have the opportunity to be assigned other liberalised rights of use across both Time Slices in the Proposed Award.
 - iii. Three is unlikely to have the ability or incentive to exploit any advantages of an additional 2x15 MHz.
- A 8.59 **In relation to (i)**, Three is unlikely to provide additional high speed services across its network using all 2x30 MHz rights of use, if the spectrum on which those services depend is due to expire in a short period. Even if Three provided such services, it would take time before the benefits to Three in terms of consumer switching (even if it occurred) could be realised.
- A 8.60 **In relation to (ii)**, the proposed award would provide Vodafone and Eir with the opportunity to compete for 350 MHz of additional rights of use in other liberalised bands (e.g. 2.3 GHz and 2.6 GHz). Further, because existing

holdings (other than 2.1 GHz) are considered as part of the competition cap, bidders with lower existing holdings having greater capacity to add spectrum to close the spectrum asymmetry. For example, given the overall competition cap of 375 MHz, ComReg notes that:

- Eir could bid for up to 190 MHz (375 MHz less 185 MHz) in Time Slice 1 and up to 220 MHz in Time Slice 2.
- Vodafone could bid for up to 180 MHz (375 MHz less 180 MHz) in both time slices.
- Three could bid for up to 155 MHz (375 MHz less 220 MHz) in both Time Slices.

A 8.61 **In relation to (iii)**, ComReg is of the preliminary view that due to a number of factors means that Three has neither the ability nor incentive to materially exploit the advantages of an additional 2x15 MHz rights of use over a short period.

- There is no certainty that Three would retain 2x30 MHz in the 2.1 GHz Band following the Proposed Award, it is also uncertain how extensively Three may choose to deploy LTE 2100 in advance of knowing what its long term holdings in the band would be.
- Any significant rollout of LTE 2100 prior to the proposed award would risk inefficient investment, if lesser, or no, rights of use were subsequently assigned in the Proposed Award.
- Three currently uses 2.1 GHz rights of use for 3G services and it will likely require some of those rights of use for UMTS beyond the Proposed Award in order to facilitate transition to LTE over an extended period.
- Three seems unlikely to advertise services based on higher theoretical speeds (a possibility referred to by Eir in response to Document 14/65) as the spectrum holding on which such claims would be made could be lost to it post award. In any event Three typically does not advertise on the basis of the speed of its services but rather on the size of its data caps (i.e. All You Can Eat)⁵³⁰
- Further, ComReg notes that GoMo, a trading name of Eircom Limited, a member of the group of companies to which Eir belongs, launched on 15 October 2019. The sim-only, online-only 'virtual' operator runs on Eir's national mobile network and has an introductory offer of 80GB

⁵³⁰ www.three.ie

of data, plus all calls and texts, for €9.99 per month for the first 100,000 customers, an offer which ends on 8 January 2020. This aligns with Eir Mobile's decision in August to rollout uncapped data usage across all its prepay, bill and small business plans. In effect, Eir would currently appear to have the capability to compete on the same basis as Three (i.e. high data caps) despite Threes 2.1 GHz short term advantage.

- Notably, Three has held more spectrum rights in other liberalised bands than Vodafone and Eir for the past five years (e.g. in the 1800 MHz Band which is already use to provide 4G services) but added fewer subscribers than Vodafone over the same period^{531 532}.

A 8.62 In light of the above, ComReg is of the preliminary view that liberalisation of all rights of use is unlikely to confer a material advantage on Three.

2. Would liberalisation at the earliest opportunity create any competition concerns?

A 8.63 Option 2A would permit the liberalisation of all existing 2.1 GHz Band rights of use but at an earlier date than Option 2B (i.e. from the time of ComReg's substantive decisions regarding the Proposed Award, instead of following the Proposed Award). In effect, competition could be better promoted as the benefits of liberalisation would occur earlier.

A 8.64 However, earlier liberalisation of all existing rights under Option 2A (compared to Option 2B) raises two additional issues for consideration.

- i. MNOs would not be able to be obtain new rights of use in the bands proposed for award (e.g. 2.6 GHz Band and 2.3 GHz Band) prior to or at the same time as the liberalisation of existing 2.1 GHz rights; and
- ii. Eir may wish to wait until after the Proposed Award to determine whether or not to liberalise its existing 2.1 GHz rights of use due to, albeit limited uncertainty, over what fees it may be required to pay.⁵³³ This would occur in circumstances where Vodafone and Three would likely have availed of liberalisation of their respective 2.1 GHz rights

⁵³¹ Assessment of ComReg Quarterly Data Q4'14 – Q3'19.

⁵³² ComReg would note this may be impacted, to some extent, by the merging of the Three and O2. Notwithstanding, it is relevant in determining any competitive impacts in the short term where Three holds what were formerly Telefonica's rights of use.

⁵³³ However Three and Vodafone would, at the same time face uncertainty as to whether or not they will win any new 2.1 GHz rights of use and regarding the fees they will have to pay for same.

soonest after ComReg's substantive decisions regarding the Proposed Award (circa 6-12 months earlier).⁵³⁴

A 8.65 **In relation to (i)**, ComReg firstly notes the main use of 2.1 GHz liberalised rights of use between the time of the substantive decision and the time of the Proposed Award would be to alleviate any capacity constraints in specific areas. In that context, an additional 2x15 MHz of liberalised rights could confer an advantage on Three if such capacity constraints could be addressed by it but not by other rival operators.

A 8.66 Based on the available information, however, ComReg does not consider that any such advantage would give rise to a material risk of a distortion of competition to the detriment of consumers, such that any benefits resulting from liberalisation would be outweighed by the detriment to consumers resulting from any such a distortion of competition. This is informed by the assessment provided above, and the following.

- Any advantage that may accrue to Three would be of a limited duration (likely circa 6 - 12 months);
- The benefits of reducing capacity constraints would only apply to certain elements of high density areas such as the cities and not on a scale likely to distort or restrict competition. Further, Vodafone and Eir would be similarly able to address such constraints (albeit to a lesser degree).

A 8.67 **In relation to (ii)**, under Option 2B any liberalisation fees that would apply to Eir's existing rights in Time Slice 1 (on the basis of ComReg's proposed potential spectrum liberalisation fee mechanism) would be known to Eir prior to making any decision to liberalise, reducing the risk that Eir would not liberalise at the time of the substantive decision. This may create competition concerns such that Eir would have unliberalised rights of use for a short period (6 – 12 months).

A 8.68 However, under Option 2A, Eir may, because of any financial exposure that may result from the potential spectrum liberalisation fee mechanism in respect of the liberalisation of its existing 2.1 GHz rights in Time Slice 1, choose to wait until after the Proposed Award to liberalise its existing rights. However, it may also decide to liberalise at the earliest opportunity, regardless of the uncertainty over potential fees. ComReg observes:

⁵³⁴ Three and Vodafone would be very likely to liberalise at the earliest opportunity because there would not be uncertainty over the fees that would apply to the liberalisation of their respective rights (i.e. these fees would be zero).

- based on the available information, it is unlikely that any liberalisation fees would apply.⁵³⁵
- furthermore, other substitutable bands are proposed to be awarded alongside the 2.1 GHz Band; and
- in light of the above factors and recalling that Time Slice 1 is circa 5.5 years, it is unlikely that Eir would choose not to liberalise its existing rights in Time Slice 1 at market-determined rates and may therefore avail of any liberalisation option at the time of the ComReg's substantive decision.

A 8.69 Even if Eir decided not to liberalise at the same time as Vodafone and Three, ComReg does not believe that any material distortion to competition would arise given the reasons identified above in respect of **issue (i)** and, in particular, that any advantage Three or Vodafone would gain would be of limited duration (circa 6 – 12 months) until the proposed availability of a large quantum of new and substitutable liberalised rights in the 2.3 GHz and 2.6 GHz bands became available.

A 8.70 Therefore, ComReg is of the view that Option 2A would be unlikely to create a material distortion to competition and is preferable to Option 2B because this would give operators the option to liberalise all of their existing 2.1 GHz rights of use at the earliest opportunity and, based on the available information, without creating material distortions of competition.

Impact on Consumers

A 8.71 It can be assumed that what is good for competition, and what promotes innovation and efficient investment in infrastructure, is, in general, good for consumers. This is because increased competition between MNOs brings benefits to their customers in terms of price, choice and quality of services.

A 8.72 Consumer demand for wireless data services has grown significantly in recent years and is expected to grow exponentially, in data volume terms, over the coming years. As licensees can provide higher data throughput using new technologies, which can only be deployed using liberalised rights of use, consumers would likely prefer the option that increases the supply of liberalised rights of use at the earliest possible opportunity. This is subject to no material distortions of competition arising in circumstances where the benefits resulting from liberalisation would be outweighed by the detriment to consumers resulting from any such a distortion of competition.

A 8.73 Whilst Option 1 would preserve existing competition up until 2022,

⁵³⁵ DotEcon Award Design Report, p22-23

consumers are unlikely to prefer Option 1 because newly liberalised rights in the 2.1 GHz Band would not become available until October 2022 (for the 2x45 MHz currently assigned to Vodafone and Three) and until March 2027 for the remaining 2x15 MHz (currently assigned to Eir). Based on the available information, there is no reason to believe that Options 2A or 2B would result in a material distortion to competition to their overall detriment. Further, as noted above, under Option, 1 Eir customers would have to wait until 2027 to receive the benefits of liberalised 2.1 GHz rights of use. Under Option 2A or 2B, consumers would be able to better utilise user devices which are compatible with LTE 2100 (which are generally widespread at this point) and benefit higher speeds and greater quality of service as described above.

A 8.74 As between, Options 2A and 2B, consumers are likely to prefer Option 2A because this would give operators the option to liberalise all of their existing 2.1 GHz rights of use at the earliest opportunity and, based on the available information, without creating material distortions of competition.

A 8.75 Therefore, ComReg is of the preliminary view that consumers are likely to prefer Option 2A.

Preferred option

A 8.76 Based on the information currently before it, ComReg is of the preliminary view that Option 2A would be appropriate in the context of ComReg's statutory framework, including being objectively justified and proportionate. Factors informing this view are outlined below.

A 8.77 **First**, Option 2A would accord with the objective of promoting competition because, among other things:

- it would be unlikely to result in a distortion or restriction of competition to the detriment of users because:
 - Any potential advantages that would accrue to Three from liberalisation would be of very limited duration (circa 6-12 months) before an additional 350 MHz of liberalised spectrum rights of use (including substitutable spectrum rights in the 2.3 GHz and 2.6 GHz bands) would be made available to all MNOs (and other interested parties) in the Proposed Award;
 - the avoidance of inefficient investment costs by all operators from having to rollout LTE 2100 after should not distort or restrict competition to the detriment of consumers generally; and

- it would facilitate MNOs LTE 2100 roll-out programme in an efficient manner, the outcome of which should contribute to users deriving maximum benefits in terms of choice, price and quality.
- the discretion of when liberalisation would occur would remain with the licensee but would also provide licensees with the opportunity to liberalise at the earliest point possible, if it so wished.

A 8.78 **Second**, Option 2A would encourage the efficient use of the radio spectrum by facilitating the commencement of LTE 2100 earlier and in a more efficient manner than other options. In particular, by avoiding inefficient investment costs caused rolling out 2.6 and 2.3 GHz when 2.1 GHz would have been preferable had it been available.

A 8.79 **Third**, Option 2A would also accord with the relevant regulatory principles which ComReg is obliged to apply in pursuit of its objectives. In particular:

- it would promote efficient investment and innovation in new and enhanced infrastructures by enabling additional LTE capacity to be provided using spectrum rights which might otherwise be underutilised.
- it would not give rise to undue discrimination in the treatment of undertakings providing ECN and ECS because all existing licensees would be able to avail of liberalised 2.1 GHz rights of use at the same time, if they so chose.
- it would accord with the principle of safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure based competition for the reasons identified above (in relation to distortion and restriction of competition).

A 8.80 **Fourth**, Option 2A would be proportionate because, among other things:

- Liberalisation of existing 2.1 GHz band rights generally accords with the principle and requirements of technology neutrality in the Common Regulatory Framework.
- it would achieve the earliest liberalisation of existing rights in the 2.1 GHz Band without giving rise to a material distortion to competition in circumstances where the benefits resulting from liberalisation would be outweighed by the detriment to consumers resulting from any such a distortion of competition; and
- there do not appear to be less onerous means by which these objectives and principles could be achieved.

Annex: 9 Draft Coverage RIA

Introduction

- A 9.1 Telecommunication services are constantly evolving and the widespread adoption of consumer devices which offer ever more advanced features and applications has changed how and where consumers communicate. Connectivity is achieved by an overlapping set of networks, devices and technologies whose use depends on the services being provided and where those services are required. Mobile is an important element of providing connectivity to consumers and the 700 MHz Duplex rights of use will be important in this regard given its excellent propagation characteristics.
- A 9.2 The 700 MHz Duplex band is the only band included in the Proposed Award which is capable of providing wide area coverage and will be an important part of the solution to address the unremitting demand in Ireland for wireless broadband services and increased connectivity. The 700 MHz Duplex Band is also important for the provision of new 5G services over widespread areas as noted by the RSPG⁵³⁶ and at EU level⁵³⁷. This Annex sets out ComReg's draft Coverage RIA and addresses different approaches to coverage obligations for the new 700 MHz rights of use.

RIA Framework

- A 9.3 The purpose, structure and scope of the RIA framework is discussed at the commencement of the draft 'Spectrum for Award' RIA which is set out in Annex 6 and is not repeated here.

Identify the policy issues and identify the objectives (Step 1)

Background and Policy Issues

- A 9.4 In Chapter 8 of Document 19/59R, ComReg sets out the background, context and policy issues and objectives that are relevant and inform the identification of the options assessed in this Annex and does not propose to set them out again here.
- A 9.5 As described in Chapter 8 of Document 19/59R, ComReg is of the

⁵³⁶ See RSPG 1st, 2nd and 3rd opinions on 5G, RSPG 16-032 Final, RSPG 18-005 Final and RSPG19-007 Final.

⁵³⁷ See for example, Recitals 9 and 10 of Decision (EU) 2017/899 UHF.

preliminary view that:

- a coverage obligation should **focus on delivering coverage to the population** rather than a focus on geographic or area coverage;
- there are good solutions for providing indoor coverage (i.e. Native Wi-Fi and mobile phone repeaters) and, as such, a coverage obligation should **focus on outdoor coverage only**; and
- in terms of quality of service, the proposed outdoor population coverage should primarily focus on **a minimum data rate of 30 Mbit/s for a single user at cell edge**.

Identify and describe the regulatory options (Step 2)

A 9.6 ComReg has identified the following options for consideration:

- **Option 1** - Impose no coverage obligation.
 - This would mean that all licensees would have full flexibility to choose how extensive their rollout would be regardless of the amount of 700 MHz Duplex rights it was assigned. For example, a licensee could choose to provide no services, only to provide services in high density areas, or choose to differentiate itself as a provider with an extensive network footprint;
- **Option 2** - Impose a coverage obligation to provide a minimum level of coverage sufficient to serve between 70% and 90% of the population, together with a minimum data rate of 30 Mbit/s for a single user at cell edge. Option 2 was informed by, among other things:
 - in the 2012 MBSA, a 70% coverage obligation was considered necessary given there was no guarantee that market forces alone would ensure the efficient use of spectrum, and that this level would prevent cherry picking (such as in densely populated areas)⁵³⁸; and
 - Oxera's view that operators providing coverage of 90% population at 30 Mbit/s appears likely even if no coverage obligation were set;
- **Option 3** - Impose a coverage obligation to provide a minimum level of coverage to serve between 90% and 95% of the population, together with a minimum data rate of 30 Mbit/s for a single user at cell edge. This option

⁵³⁸ 70% of the population corresponds cities and towns including towns under 500 population but with at least 50 inhabited houses.

was informed by Oxera's view that such a coverage obligation would appear feasible for an existing MNO to meet; and

- **Option 4** - Impose a coverage obligation to provide a minimum level of coverage to serve 95 - 99.5% of the population, together with a minimum data rate of 30 Mbit/s for a single user at cell edge. This option would provide high speed services to very high levels of the population.

A 9.7 Each of the above options are symmetric⁵³⁹ in that all 700 MHz licensees would be required to meet the same minimum coverage targets under the same conditions. As discussed in Chapter 8, ComReg proposes to impose Native Wi-Fi and VoLTE obligations in the case of Options 2 – 4.

Impact on industry stakeholders, competition and consumers (Steps 3 and 4)

A 9.8 The following sections of the draft 'Coverage RIA' consider the impact of the aforementioned regulatory options on:

1. industry stakeholders (being existing operators and potential new entrants)
2. competition, and
3. consumers.

A 9.9 ComReg notes that it intends to further develop this draft RIA in light of any further feedback from all stakeholders to this consultation.

Impact on industry stakeholders

A 9.10 Industry stakeholders can generally be split between those operators that are currently active in the electronic communications sector and potential new entrants that may be considering entry into the electronic communications sector in the State.

A 9.11 At the outset, ComReg observes that stakeholder views are likely to be informed by the costs of delivering coverage above existing levels (i.e. 63% of the population having a 30 Mbit/s service)⁵⁴⁰. In particular, the Oxera Report finds that, while certain levels of coverage can be achieved with low levels of investment, the cost of coverage rises exponentially at high levels of coverage (across all scenarios). The figure below shows how the cost of

⁵³⁹ See Chapter 8 for ComReg's views in relation to interventionist coverage obligations and potential asymmetric coverage obligations.

⁵⁴⁰ See Table 5.1 (Oxera Report – Document 18/103c) which predicts that around 63% of the population have a 30 Mbit/s service.

providing 30Mbit/s population coverage rises exponentially after 95% coverage.

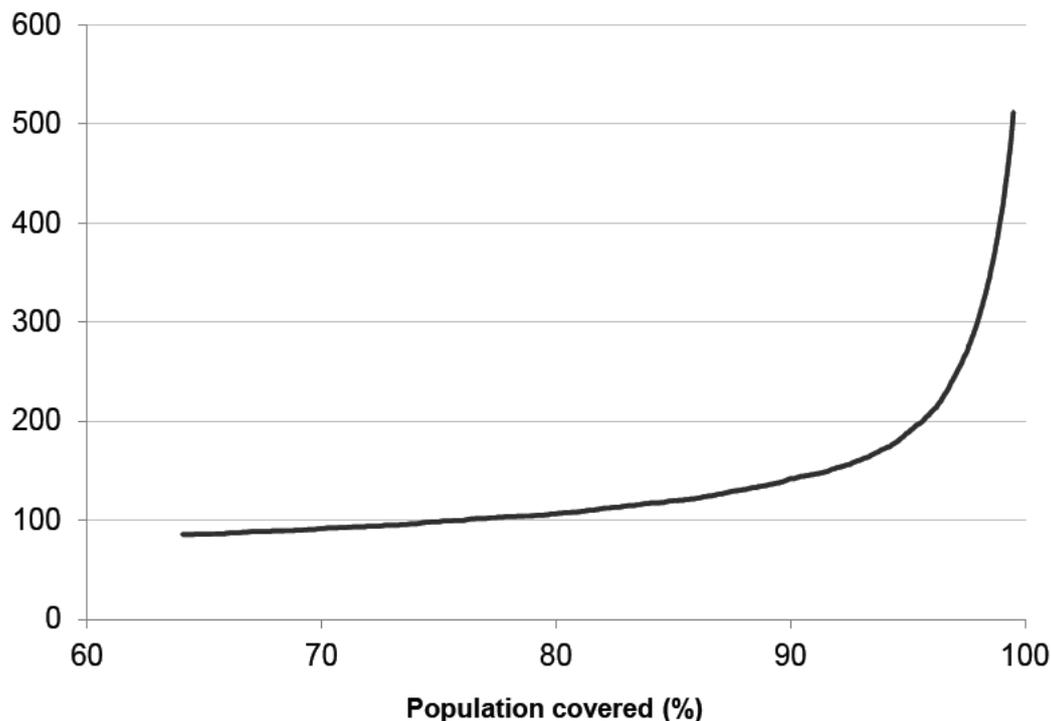


Figure 12: Estimated cost of targeting 30Mbit/s population coverage, starting 2020⁵⁴¹

A 9.12 ComReg assesses the views of various stakeholders below.

Option 1 – no coverage obligation

Incumbent MNOs

A 9.13 Under Option 1, a winning bidder would have full flexibility to choose how extensive their network coverage would be and what QoS standards (e.g. speed) would apply. In that regard, ComReg notes that MNOs are already providing 30 Mbit/s coverage to various parts of the State. For example, the Oxera Model predicts that the synthetic mobile network operator used in its analysis would have achieved 64% population coverage of 30 Mbit/s by 2020⁵⁴² (62.4% in 2017)⁵⁴³. Given the potential for new entry (e.g. a mix of spectrum above and below 1 GHz), existing operators are likely to favour some form of obligation in order to ensure that potential new entrants do not cherry pick more profitable areas forcing MNOs to compete against the

⁵⁴¹ Future Mobile Connectivity in Ireland - a report (Document 18/103c) from Oxera Consulting LLP ("Oxera"), with Real Wireless Ltd – p6

⁵⁴² Ibid, p. 61.

⁵⁴³ Ibid, table 4.3.

cherry-picker's lower price in the more profitable urban areas.

A 9.14 In that regard, it is apparent from submissions to Document 19/59R that all three MNOs favour the imposition of some coverage obligation although they are not all in agreement as to what the level of that obligation should be (see below).

A 9.15 Therefore, on balance, MNOs are unlikely to prefer Option 1 as services would already be provided at 30 Mbit/s to circa 64% of the population and a new entrant may use rights of use to cherry pick if the obligation is set too low.

New entrants

A 9.16 Potential new entrants are likely to prefer an option with as low a rollout obligation as possible, and therefore Option 1 could be their preferred option. This would give an entrant maximum flexibility in its choice of business model, including potentially allowing it to offer services focused on limited geographical areas, such as services targeting urban areas. However, given that such entrants would rollout a network to some degree, regardless of any obligation, a new entrant might well be indifferent between Option 1 and Options that mandate it to rollout coverage at 30 Mbit/s (or lower where it is assigned less than 2x30 MHz) in line with its commercial strategy.

MVNOs

A 9.17 MVNOs would likely prefer the option that maximises the level of coverage that would be available to provide to their customers. In that regard, they are unlikely to prefer Option 1 as this could lead to sub-optimal levels of coverage as described in 'Impact on Competition' below.

Assessment of Options 2, 3 and 4.

A 9.18 Before assessing each of the remaining options individually, ComReg first sets out some relevant information that would form part of each assessment. The extent to which a stakeholder would likely prefer an option is largely dependent on the extent to which an obligation would be commercially achievable in a competitive market. In that regard, the remainder of the stakeholder assessment refers to Oxera's observations on likely commercial deployment by MNOs following an award process for 700 MHz Duplex rights of use. Oxera's observations have been informed by a number of factors, including:

- The availability of three-band carrier aggregation from mid-2020 and deployment of same by operators using 2x10 MHz of 700MHz

spectrum, 2×10 MHz of 800 MHz spectrum, and 2×10 MHz of 900 MHz spectrum⁵⁴⁴;

- The number of additional sites and upgrades to existing sites required to provide a given level of coverage;
- The cost of rollout at a given annual rollout rate (i.e. 2.5% up to mid-2020 and 8.04% from mid-2020 onwards to allow the roll-out to be completed within 10 years);
- Interviews with stakeholders and historic investment trends of Irish MNOs.⁵⁴⁵

A 9.19 ComReg notes that Oxera’s observations on likely commercial deployment refers to all incumbent MNOs regardless of their existing network. As noted above, the assessment is based on historic investment trends and interviews with MNOs. Further, the synthetic network is based on the licensed site numbers, site locations, and licensed frequency bands of Vodafone and Eir. In particular, the starting number of base stations in the synthetic network (1,890) is almost identical to Eir’s (1,876) and slightly below Vodafone’s (1,931).⁵⁴⁶ Finally, according to Oxera, achieving up to 95% coverage requires an additional 378 sites, [redacted] In effect, Oxera’s observations could be achieved by all MNOs regardless of size.

A 9.20 MNO’s views are likely to be informed by a number of factors including:

- The likely level of network investment that would be required to be spent on improving mobile coverage. Based on historic investment data, Oxera estimates that this would require an annual investment to improve mobile coverage of €8m – €19m, for each MNO.⁵⁴⁸
 - The €8m - €19m investment range is the same for each option below.

⁵⁴⁴ The 700MHz band and Carrier Aggregation reduces the cost of providing coverage (as site upgrades cost less than building new sites).

⁵⁴⁵ Mobile investment data used from the European Commission (European Commission ‘Telecommunications data files’). These figures include investments other than improving the coverage of connectivity and therefore represent an upper-bound estimate of the historical level of capital investment in improving mobile coverage.

⁵⁴⁶ Future Mobile Connectivity in Ireland - a report (Document 18/103c) from Oxera Consulting LLP (“Oxera”), with Real Wireless Ltd – Table 4.1

⁵⁴⁷ [redacted]

⁵⁴⁸ Using a conservative estimate of only 10 – 20% of network investment being spent on improving mobile coverage.

- The total capex cost to rollout coverage to certain levels of population. Total Capex arises from investment in new sites and upgrades to existing sites.
 - The total Capex cost varies across each option below.
- The total number of sites and upgrades required over specified periods.
 - The number of sites and upgrades varies across each option below.
- When coverage levels would be achieved by. Oxera uses a rollout rate of 2.5 % which is based on historical site rollout following the 2012 MBSA.⁵⁴⁹
 - The rollout rate is the same for each option below.

A 9.21 The remaining options are assessed against the extent to which the Capex costs required fall within the likely coverage investment range.

Option 2 – 70 to 90% population at 30 Mbit/s cell-edge

MNOs

A 9.22 Oxera considers that it is **likely** that MNOs will expand coverage up to 90% of population (based on purely commercial incentives). Oxera forms this view based on the observation that the incremental cost of expanding 30 Mbit/s coverage from current levels (i.e. circa 65%) to 90% is low (compared to the incremental cost at higher levels of coverage) and it is likely that the commercial case for expanding 30 Mbit/s coverage would exceed the costs of doing so. The investment required is likely to be well within that which was invested by MNOs in the period 2010–16, implying that the level of investment is not unprecedented.

- A total Capex cost of €44m would be required to rollout to 90% of population over a 3 – 4 year period.⁵⁵⁰
- An annual investment of €11m (at the lower end of the €8m - €19m investment range) would achieve 90% coverage.

⁵⁴⁹ Based on a four-year growth rate (2013–2017) of licensed sites in the frequency bands with the highest number of sites (i.e. the 900 MHz band for Vodafone and the 900 MHz and 2100 MHz bands for Meteor).

⁵⁵⁰ €16m would be required for 80% coverage and €27m for 85% coverage.

- Coverage to 90% would require 270 new sites and 825 upgrades to the existing network.⁵⁵¹
- Coverage to 80%, 85% and 90% would be achieved in 2022, 2023 and 2024 using the historical rollout rate.

A 9.23 Only at low levels of annual investment within the €8 – €19m investment range (i.e. €10m or less per year) would 90% coverage not be achieved. This seems unlikely to arise given an operators decision to invest in 700 MHz rights of use (2x10 MHz likely to exceed €50m)⁵⁵² and competition between operators to provide better coverage and higher quality of service.

A 9.24 Therefore, MNOs would likely be indifferent to Option 2 compared to Option 1 because such obligations largely coincide with likely commercial rollout, would impose little if any cost and could be achieved using a rollout rate consistent to what was achieved after the 2012 MBSA.⁵⁵³

New entrants

A 9.25 Given the need to provide coverage on a new network rather than an existing one, new entrants are likely to prefer a lower coverage obligation compared to existing MNOs.

A 9.26 In order to assess a new entrant's likely commercial rollout, Oxera models two variants^{554 555} for the network evolution of a new entrant targeting 30 Mbit/s (moderate and aggressive). Oxera is of the view that an initial rollout across both scenarios of 1,084 macrosites would correspond to coverage of:

- 75% population in 2 years.
- 85% population in 5 years.
- 90% population in 9 years.

A 9.27 Therefore, an entrant competing directly with existing MNOs with a national network is unlikely to be significantly constrained by Option 2, as it would anyway choose to provide these coverage levels (albeit over a slightly

⁵⁵¹ Coverage to 80% would require 204 sites and 363 upgrades. Coverage to 85% would require 227 sites and 568 upgrades.

⁵⁵² See Section 4.2.2 Document 18/103d.

⁵⁵³ Increasing coverage from 64% to 90% would require an additional 98 sites and 565 upgrades to existing sites.

⁵⁵⁴ Future Mobile Connectivity in Ireland - a report (Document 18/103c) from Oxera Consulting LLP ("Oxera"), with Real Wireless Ltd – Figure A3.8.

⁵⁵⁵ This corresponds to a new entrant winning 2x10 MHz (700 MHz) and 2x20 (2.6 GHz). See Future Mobile Connectivity in Ireland - a report (Document 18/103c) from Oxera Consulting LLP ("Oxera"), with Real Wireless Ltd – Table 4.6

longer time horizon than existing MNOs). An obligation set within this range reflects the likely network rollout of a new entrant targeting 30 Mbit/s. The new entrant obligation is described in more detail in Chapter 7.

MVNOs

A 9.28 MVNOs are likely to prefer Option 2 over Option 1 as 30 Mbit/s coverage would likely be provided across a wider area than under Option 1.

Option 3 - 90 to 95% population at 30 Mbit/s cell-edge

MNOs

A 9.29 Oxera considers that expanding coverage up to 95% of population is **possible**, for MNOs given cost and network roll-out considerations. Under Option 3, the incremental cost (i.e. cost of serving additional population) increases exponentially as the coverage rises (especially above 90%), as more investments (particularly in new sites) are required to achieve incremental increases in coverage, as illustrated in Figure 12 above.

- A total Capex cost of €82m would be required to rollout to 95% of population over a 7 period.⁵⁵⁶
- An annual investment of around €12m (at the lower end of the €8m - €19m investment range) would achieve 95% coverage.
- Coverage to 95% would require an additional 378 new sites and 1,197 upgrades to the existing network.
- Coverage to 95% would be achievable by 2027 applying the historical rollout rate

A 9.30 Only at low levels of annual investment within the €8 – €19m investment range (i.e. €11m or less per year) would 95% coverage not be achieved. At these levels, investment would be €77m over a 7 year period which is less than the €82m Capex that would be required. Alternatively, an annual investment of €12m over 7 years would result in an overall investment of €84m, i.e. above the investment level required to achieve 95%.

A 9.31 While there is less certainty that the commercial case for expanding 30 Mbit/s coverage to 90-95% would exceed the costs of doing so, these costs are within the range of what operators have invested historically. In that regard, MNOs may be willing to compete up to 95% of the population given

⁵⁵⁶ €16m would be required for 80% coverage, €27m for 85% coverage and €44m for 90% coverage (“Oxera”), with Real Wireless Ltd – Table 5.8.

that coverage up to 90% is highly likely. Each MNOs makes their own network rollout plans and some might prioritise greater coverage levels and in different areas than others. However, all operators compete against each other in the same market and, over time, it is reasonable to expect all operators to reach a broadly similar coverage range.

A 9.32 Further, some important features of the market that have limited existing levels of coverage may be remedied over time. In particular, the Mobile Broadband Taskforce has identified constraints which can impede connectivity and its activities are therefore important in removing bottlenecks and improving efficiency, reducing the costs of roll out. Actions include:

- Streamlining planning processes for the deployment of telecommunications infrastructure.
- Installing ducting on new national primary/secondary roads.
- Developing and publishing a policy for all local authorities around access to and use of state infrastructure

A 9.33 The implementation of these actions should remove constraints that would have limited the extent to which coverage could be extended beyond 90% (and have restricted the extent to which operators have extended coverage to date). As noted by DotEcon, coverage roll-out will be encouraged by the reduction of such impediments.⁵⁵⁷ In particular, access to road ducting should provide opportunities for operators to expand road coverage. Additional road coverage would also lead to incidental coverage in terms of both population and geography.

A 9.34 Further, ComReg notes that, in their responses to Document 19/59R two of the three MNOs supported the view that mobile operators could competitively achieve coverage up to 95%. For example:

- Eir agrees with coverage obligations set on a precautionary basis and supports such an obligation being set at 95% of the population.
- Three supports ComReg's proposals in this regard but notes that such obligations are at the upper-end of what network operators could be expected to meet under competitive commercial conditions. It contends that any further obligations would likely act as a deterrent to bidders in the auction.

⁵⁵⁷ DotEcon Report (Document 18/103d), p 35.

- Vodafone contends that there is no commercial incentive to roll-out coverage beyond a figure in the lower 90% range of population which would be the likely final figure reached without intervention.

A 9.35 ComReg notes Three's and Eir's advertisement that a coverage obligation of 95% is achievable on a commercial basis. Though, ComReg agrees that such obligations are likely at the upper end of what could be achievable and obligations above 95% (while possibly achievable by some) would likely risk distortion to the award process.

A 9.36 In relation to Vodafone's view, ComReg would note the following.

- At paragraph 16 of its response to Document 19/59R, Vodafone has quoted an extract from ComReg Document 18/103 which is based on a rollout period of five years, while Option 3 (95%) refers to a rollout rate of 7 years. Under Option 3, a five year rollout rate would correspond to a rate of 92%⁵⁵⁸ meaning the difference between Option 3 and Vodafone's assessment is relatively small.
- Vodafone claims to already achieve a 98% population coverage⁵⁵⁹ for 4G meaning that the coverage footprint already exists and it would in effect only have to focus on the upgrade of existing sites in order to satisfy the QoS aspect of the obligation (i.e. 30 Mbit/s).
- Rival operators who both have lower market shares and in some cases (particularly Eir)⁵⁶⁰ a less developed network all acknowledge that a 95% rate is commercially achievable. It is not plausible that the operator with the most subscribers would provide coverage at materially lower rates than smaller rivals.⁵⁶¹

A 9.37 Therefore, while Vodafone may prefer Option 2 over Option 3, it seems reasonable to conclude that it is commercially viable for existing MNOs to rollout coverage to more than 90% of the population.

New entrants

A 9.38 As noted earlier, a new entrant coverage obligation of 75% population would likely be possible over a 2 year period, increasing to 90% over 9

⁵⁵⁸ ComReg also note that 92% is within "the lower 90 percentile range of population" referred to in Document 18/103.

⁵⁵⁹ <https://n.vodafone.ie/aboutus/press/vodafone-ireland-extends-5g-network-test-bed-as-it-prepares-for-.html>

⁵⁶⁰ Eir has less sites and spectrum rights of use than both Three and Vodafone.

⁵⁶¹ For example, Didier Clavero, Vodafone Ireland CTO, recently noted that Vodafone "continually work(s) hard to maintain our position as the leading voice and data mobile provider in the country". <https://n.vodafone.ie/aboutus/press/vodafone-ireland-extends-5g-network-test-bed-as-it-prepares-for-.html>

years. In that regard, a coverage obligation set above 90% would likely exceed what a credible new entrant could commercially achieve over a 10 year period. New entrants are therefore unlikely to prefer Option 3 over Option 1 and Option 2.

MVNOs

A 9.39 MVNOs are likely to prefer Option 3 over Option 2 as 30 Mbit/s coverage would likely be provided across a wider area than under Option 2.

Option 4

MNOs

A 9.40 Oxera considers that expanding coverage beyond 95% of the population, absent external intervention (e.g. government procurement/subsidy), is **unlikely** for MNOs given cost and network roll-out considerations. Under Option 4, the incremental cost of expanding coverage is much greater than that for increasing coverage at lower levels because more investment in new sites is required as opposed to upgrades of existing sites.

- A total Capex cost of €82 - €397m would be required to rollout to 95 – 99.5% of population over a 7 period.⁵⁶²
- An annual investment at the extreme end of the €8 - €19m investment range) could achieve marginal coverage gains beyond 95% (over a 7 years period) but this is subject to uncertainty.
- Achieving population coverage of 99.5% would require an additional 1,466 sites and 1,603 upgrades to the existing network.
- Achieving population coverage of 99.5% would be achievable by 2042 applying the historical rollout rate. Increasing the speed of rollout would increase costs substantially.

A 9.41 Only at the outer boundary of the €8 – €19m investment range would 99.5% coverage be commercially achieved and this would only likely be achieved by 2042. This is unlikely to arise commercially given previous historical investment, the low levels of additional population such rollout would cover and that competition between operators is unlikely to drive it to such levels. Option 4 would potentially involve constraining the commercial choices of at least some network operators and force coverage in excess of

⁵⁶² €16m would be required for 80% coverage, €27m for 85% coverage, €44m for 90% coverage and €83m for 95% coverage. (“Oxera”), with Real Wireless Ltd – Table 5.8.

competitively determined levels.

A 9.42 Oxera is of the view that these costs arise because the cost of providing coverage increases exponentially for the last 5% of population⁵⁶³. While the last 5% will be the most costly 5% of coverage given the falling population density, the exponential increase in cost is significant when targeting 30 Mbit/s population coverage. Further, while the cost of serving the last 5% is significantly higher the additional revenue likely to be generated from serving the additional population is significantly lower.⁵⁶⁴ It is therefore much less likely that the commercial case for expanding 30 Mbit/s coverage will exceed the costs of doing so. In addition, the investment required may exceed that which was invested by the Irish MNOs in the period 2010–16, implying that the required level of investment seems unlikely.

A 9.43 Further, coverage levels above 95% would take significant periods of time to deliver. For example, increasing coverage from 95% to 97.6% would take around 4 years, the same time required to go from 64% to 90% of population. Operators are also unlikely to continually rollout additional sites to increase coverage at these high levels, particularly where each site is associated with ever decreasing levels of population. Therefore, while some MNOs with high levels of investment may marginally extend coverage beyond 95%, MNOs are unlikely to prefer Option 4 over other options particularly if such an obligation was to be symmetric.

New entrants

A 9.44 New entrant coverage of 75% population would be possible over a 4 year period, increasing to 90% over 9 years. In that regard, a coverage obligation set above 95% would likely exceed what a credible new entrant could reasonably achieve commercially, over the same period (for the same reasons noted in relation to incumbent MNOs above). New entrants are therefore unlikely to prefer Option 4 over other options.

MVNOs

A 9.45 While MVNOs may prefer Option 4 over Option 3 as 30 Mbit/s coverage would be provided across a wider area it is likely that the costs of providing

⁵⁶³ This arises because the last percentages of the population live in the least dense areas which tend to be topographically challenging, and the cost of expanding the network to those areas is greater. For example, the last 3% of the population live in 28% of the area of Ireland meaning the cost per population increases and more base stations are needed to cover the same number of households.

⁵⁶⁴ As noted by DotEcon (Document 18/103d), MNOs are unable to discriminate in pricing between customers who benefit from the coverage increment and those who do not. MNOs would need to raise prices slightly for all customers to extract any of the additional value created by its greater coverage footprint, which means it will potentially lose some customers who do not value the additional coverage. The Mobile Consumer Experience Survey suggests that consumers have a very limited willingness to pay more for a service even if it did have greater coverage.

coverage beyond what is commercially viable would be passed on to MVNOs. Therefore, MVNOs are unlikely to prefer Option 4 over other options.

Impact on Competition

Background information

- A 9.46 ComReg first sets out some background information that is relevant to the competition assessment in each of the regulatory options below.
- A 9.47 Competition in the retail mobile communications market is multi-faceted and operators compete across a range of factors including, price, handsets, bundles, and coverage. Network operators have clear competitive incentives to build out coverage in order to attract new subscribers and increase the benefits of all subscribers using the network. Normally, precautionary type coverage obligations imposed by regulators are exceeded as coverage is driven by competition between network operators.
- A 9.48 For example, in the 2012 MBSA, existing MNO winning bidders were obliged to achieve and maintain a minimum coverage obligation of 70% of the population of Ireland within 3 years from the commencement date of the licence. ComReg's Summer 2016 Drive Test confirmed that all operators were in compliance with their licence conditions after three years, with coverage in excess of the 70% obligation.⁵⁶⁵ The results of the latest round of Drive Testing, indicate that the minimum coverage by population achieved during the Drive Test was greater than 90%⁵⁶⁶.
- A 9.49 Thus, it may not be necessary to impose a coverage obligation where competition itself can be expected to push coverage to desired levels. However, even in competitive markets there is no guarantee that competition will deliver and maintain an acceptable level of coverage across the country. DotEcon⁵⁶⁷ advises that coverage obligations may still be necessary to reduce the risks of competitive failures for a number of reasons, including but not limited to (i) tacit collusion and (ii) cherry picking.

(i) Tacit Collusion

- A 9.50 DotEcon advises that MNOs could have collective incentives to come to a tacit understanding to maintain the status quo and avoid making significant

⁵⁶⁵ Document 16/113, 'Assessment of Mobile Network Operators' Compliance with Licence Obligations (Coverage) Summer 2016' published December 2016.

⁵⁶⁶ Document 19/87, 'Assessment of Mobile Network Operators' Compliance with Licence Obligations (Coverage) Summer 2019' published September 2019.

⁵⁶⁷ Document 18/103d, 'Coverage obligations and spectrum awards a report from DotEcon Ltd, published November 2018 – Section 2.2.2.

network investments, such as might be needed to increase coverage. Tacit collusion may be more prevalent with repeated interaction between a stable set of competitors unchallenged by new entry with high levels of transparency about the conduct of rivals. For example:

- The Irish market has in recent years been reduced from four to three MNOs and if no new entrant arose from this proposed award, new entry by an additional MNO is unlikely to be possible until after 2030 when new rights of use (particular coverage spectrum) will be assigned.
- MNOs are likely to be able to monitor any significant coverage expansion by a rival operator (indeed operator's coverage is already publicly monitored by ComReg)⁵⁶⁸.

A 9.51 Operators are likely to benefit from expanding coverage where the costs of incremental increases in coverage are relatively low and each base station serves a relatively large population. However, as the cost per population increases, so do the incentives for operators to collude tacitly to avoid or delay the cost of network investments that they would otherwise have made.⁵⁶⁹ This would have the effect of keeping coverage below levels that would have been achieved under absent such collusion.

A 9.52 Table 14 below shows that at higher levels of coverage the cost of each additional percentage of coverage increases, meaning that more base stations are needed to cover the same number of households and therefore the cost per population increases. Therefore, the risk of tacit collusion is higher at higher levels of coverage and cost.

Table 14: Sites, Upgrades & Costs required for incremental coverage per operator⁵⁷⁰

Coverage	Sites	Upgrades	Cost, €m
85%	23	205	11
90%	43	257	17
95%	108	372	38

⁵⁶⁸ <https://www.comreg.ie/outdoor-mobile-coverage-map/>

⁵⁶⁹ DotEcon (18/103d) notes that the costs involved in expanding coverage in certain cases may create incentives not to be a first-mover and only to respond if others move first. When costs get to a certain level, operators may wait to see what other operators do i.e. it would only be worth expanding coverage if other operators were there first.

⁵⁷⁰ Document 18/103d, 'Coverage obligations and spectrum awards a report from DotEcon Ltd, published November 2018 - based on Table 5. 8

A 9.53 Coverage obligations are required to guard against tacit collusion which deters investment in respect of extending coverage to save on the costs of incremental network rollout.

(ii) Cherry Picking

A 9.54 DotEcon observes (Document 18/103d) that coverage obligations can protect against the possibility of one network operator 'cherry-picking' by covering only the most profitable locations (e.g. urban areas). There are two versions of cherry picking relevant to the assessment in this draft RIA.

- Coverage 'cherry picking' where coverage is provided in urban areas such as cities or large towns and not provided elsewhere. In the 2012 MBSA, ComReg considered it appropriate to set a 70% population coverage obligation as, among other things, this would prevent cherry picking in densely populated areas.
- Quality of Service (QoS) 'cherry picking' where an MNO only provides high speed service (30 Mbit/s) in urban areas and a basic service elsewhere. Given that MNOs are already serving large portions of the population with basic 4G services, higher speed services could be provided in urban areas while consumers in rural areas would only be provided with more basic connectivity.

A 9.55 ComReg therefore assesses below the impact of each option on competition under the following headings: tacit collusion, cherry-picking, new entry and commercial viability.

Option 1

A 9.56 Option 1 would impose no coverage obligation and operators would have full flexibility to choose how extensive their rollout would be.

Tacit Collusion

A 9.57 MNOs could come to a tacit understanding to avoid making network investments to increase coverage to certain levels in order to save on network rollout costs. While certain levels of coverage can be achieved with low levels of investment, the cost of coverage rises exponentially at higher levels of coverage increasing the potential gains from a tacit arrangement. In that regard, requirements to roll-out services to a certain level within a certain timeframe may be sufficient to destabilise tacit understandings to delay or reduce rollout.

Cherry Picking

- A 9.58 In relation to 'cherry picking' given that incumbent MNOs are already providing a service to a high percentage of the population, cherry picking refers to QoS 'cherry picking' where an operator only provides high speed services (30 Mbit/s) in urban areas and a basic service elsewhere. As noted by DotEcon (18/103d), there could be a risk of the mode of competition changing to one where the emphasis is on targeting urban customers with higher speed services.
- A 9.59 Such a strategy can undermine provision to rural areas as such an operator would not be exposed to the costs of expanding into the less profitable rural areas, but rivals would nevertheless need to compete against the lower price in the urban areas. A coverage obligation can protect against the possibility of one or more MNOs only delivering a 30 Mbit/s services to higher density areas to the detriment of more rural areas.

New entry

- A 9.60 Tacit understandings are unlikely to be relevant to new entrants whose main priority would be rolling out a new network. Further, Option 1 could promote competition because it would not run the risk of precluding new entry through setting an obligation that could not reasonably be obtained by a new entrant. However, there would be a risk of a new entrant only serving the more profitable urban areas i.e. coverage 'cherry picking'. Such entrants would not be exposed to the costs of expanding into the less profitable rural areas, but existing MNOs would nevertheless need to compete against the cherry-picker's lower price in the urban areas. If a new entrant was permitted to cherry pick in this way other MNOs would need to compete against the cherry-picker's lower price in the urban areas thereby undermining the viability of extending coverage to rural areas to the extent that this relies on cross-subsidisation⁵⁷¹ from urban areas. Therefore, some form of coverage obligation is also necessary to prevent coverage 'cherry picking' by a new entrant.

Commercial viability (MNOs)

- A 9.61 There are no concerns about the commercial viability of Option 1 since no obligation would be imposed.

⁵⁷¹ A coverage obligation can be used as a tool to encourage the provision of coverage of rural areas, There is a strong argument for applying a precautionary coverage obligation homogeneously to all licensees so as not to distort service market competition. All operators would face similar constraints on the pricing of services created by the same coverage obligation and would compete to dispatch the obligation at least cost.

Preliminary view on Option 1

- A 9.62 While ComReg considers competition would likely drive actual coverage to high levels, it is nevertheless appropriate to set a coverage obligation given that there is no guarantee that market forces alone would ensure optimal coverage outcomes. Setting a coverage obligation would prevent QoS ‘cherry picking’⁵⁷² and reduce the incentives for tacit collusion to keep coverage lower than should be reasonably expected from a well-functioning market.
- A 9.63 Therefore, ComReg is of the preliminary view that Option 1 would risk distortions to competition which could deliver and result in sub-optimal coverage outcomes to the detriment of consumers, particularly those in less dense areas outside the major urban centres.

Option 2

Cherry picking

- A 9.64 Under Option 2, the opportunities for QoS ‘cherry picking’ are reduced as an MNO would be obliged to provide 30 Mbit/s population coverage to between 70 and 90% of the population. A coverage obligation, particularly at the higher end of the 70 – 90% range would remove the incentive for operators to cherry pick the most profitable high density areas and provide higher speed service in urban areas only. For example, all areas with a population of at least 50 households accounts for 70% of the population.⁵⁷³ Setting the coverage obligation at levels beyond 70% would likely result in all operators serving all towns above a population of 50.
- A 9.65 While parts of the remaining 10% - 30% of the population could be served under effective competition these are the least profitable areas given the lower population densities and would unlikely be a target for a cherry-picking strategy. Because the obligation includes a requirement to provide speeds of 30 Mbit/s, an obligation set at the higher end of the range (i.e. closer to 90%) would also reduce the possibility of only providing a high speed 30 Mbit/s in more densely populated areas and a basic service elsewhere (although there remains a residual risk of this particularly at the lower end of the range). For example, if the obligation was set at 70% of population an operator could target all towns above a population of 50 with a high speed service (30 Mbit/s) and a lower speed service (3 Mbit/s) in more rural areas, including terrestrial routes. However, given that 70% of the population is located in just 3% of the area of Ireland, there could still

⁵⁷² It would also prevent coverage cherry picking by a new entrant.

⁵⁷³ Census 2016.

be large parts of rural Ireland that would not be served with a 30 Mbit/s service if the obligation was set in this range.

Tacit collusion

A 9.66 The risk of tacit collusion is highest for higher levels of coverage because the network costs to be avoided (for lower levels of incremental coverage) are higher. In the 90 – 95% range operators would retain a higher level of costs compared to lower levels of coverage. For example, the cost of extending coverage at 30 Mbit/s from 90% to 95% is double the cost of going from 65% to 90%, providing incentives for operators to keep coverage at around 90%. Under Option 2 there would remain a risk of tacit collusion between network operators to defer investment and not extend coverage beyond 90%.

New entry

A 9.67 Higher levels of coverage run the risk of acting as a barrier to entry for new entrants. Nevertheless, as noted above, 30 Mbit/s coverage of 75 - 90% over 3 to 9 years is likely to be achievable, on a commercial basis, for a new entrant. In effect, Option 2 would be unlikely to act as a barrier to entry provided the overall timeframe for meeting the obligation was appropriate.

A 9.68 Further, Option 2 would prevent any new entrant from cherry picking urban areas and avoiding the costs of expanding into the rural areas.

Commercial viability (MNOs)

A 9.69 As noted above in 'Impact on Stakeholders' a coverage obligation set in the 70 – 90% range would not be in excess of what could be provided commercially by MNOs given the factors assessed by Oxera, including the availability of carrier aggregation, cost of rollout, previous network investments and stakeholder interviews.

Preliminary view on Option 2

A 9.70 While Option 2 would be better for competition than Option 1 there are residual risks that competition could be weakened when compared with Option 3. In particular, while Option 2 (particularly at the higher end) largely addresses cherry picking concerns there remains a risk of tacit collusion resulting in sub-optimal levels of coverage to the detriment of consumers, particularly those in more rural areas.

Option 3

Cherry Picking

A 9.71 No opportunity for cherry picking exists under Option 3 since an operator would be obliged to provide 30 Mbit/s population coverage up to 95% of the population which is close to the coverage limits that competition alone would achieve. The remaining 5% or so would be unlikely to be profitable providing no further opportunities for cherry picking.

Tacit collusion

A 9.72 Under Option 3, no real opportunity for tacit collusion aimed at avoiding or delaying the costs of expanding coverage would likely exist as all operators would be required to provide up to 95% population coverage. Opportunities for tacit collusion are likely to be limited since 95% is already likely approaching the limits of competition in a well-functioning market. Indeed, under Option 3 the incentive for operators would be to reach 95% rather than expanding beyond it.

New entry

A 9.73 Option 3 would likely act as a barrier to entry over the time periods considered in Chapter 7 (i.e. as coverage set at these levels would be above what Oxera considers possible for new entrant (75 - 90% over 3 to circa 9 years).

Commercial viability (MNOs)

A 9.74 As noted above in 'Impact on Stakeholders' a coverage obligation set in the 90 – 95% range would not be in excess of what could be provided commercially by MNOs given the factors assessed by Oxera.

Preliminary view on Option 3

A 9.75 In relation to existing MNOs, Option 3 would better promote downstream competition than Option 2. However, Option 3 would likely be too high for new entrants (over the 10 year period considered in Chapter 7) and a lower coverage obligation would likely be needed to promote new entry.

Option 4

Cherry picking and tacit collusion

A 9.76 Under Option 4, tacit collusion and/or cherry picking would be very unlikely as operators would be obliged to provide coverage at levels above what

would likely be provided on a commercial basis under effective competition.

New entry

A 9.77 New entrant coverage of 75% population would be possible over a 4 year period, increasing to 90% over 10 years. In that regard, a coverage obligation set above 95% would likely exceed what a credible new entrant could reasonably achieve commercially, even over an extended period of time (for the same reasons noted in relation to incumbent MNOs above). Option 4 is therefore likely to raise barriers to entry when compared to other options.

Commercial Viability (MNOs)

A 9.78 Given the factors assessed by Oxera a coverage obligation set in the 95% + range would run the risk of being in excess of what could be viable for MNOs. Oxera notes that the incremental cost of expanding coverage is much greater than that for increasing coverage to the levels specified in the other options. It is therefore much less likely that the commercial case for expanding 30Mbit/s coverage will exceed the costs of doing so.

A 9.79 For example, the estimated cost of increasing coverage from 99.0% to 99.5% is €102m. This is over four times greater than the estimated cost of increasing coverage from 97.0% to 97.5%, which is €24m⁵⁷⁴. Further, the investment required may exceed that which was invested commercially by the Irish MNOs in the period 2010–16, implying that the required level of investment to support such coverage levels appears unlikely.

A 9.80 While some MNOs may marginally extend coverage beyond 95%, the extent of this is likely to be limited given the costs on rollout. Further, other MNOs with alternative commercial footprints may be able to effectively compete at around 95% and a higher obligation would possibly favour some MNOs over others. Therefore, an obligation set above 95% would run the risk of extending coverage beyond the limits that competition alone might deliver. DotEcon refers to such obligations as ‘interventionist coverage obligations’ and they are discussed below.⁵⁷⁵

Interventionist coverage obligations

A 9.81 DotEcon advises that ‘interventionist’ coverage obligations may distort

⁵⁷⁴ Document 18/103d, ‘Coverage obligations and spectrum awards a report from DotEcon Ltd, published November 2018, p72 -73.

⁵⁷⁵ Document 18/103d, ‘Coverage obligations and spectrum awards a report from DotEcon Ltd, published November 2018, Section 2.4.

spectrum awards and reduce competition in a number of ways including:

- i. the cost of providing the coverage obligation could be in excess of the value of the spectrum to which the obligation is imposed, resulting in lots going inefficiently unsold⁵⁷⁶;
- ii. some bidders may be better able to meet the obligations than others, leading to reduced competition⁵⁷⁷ for any coverage lots (allowing an operator to pick up spectrum below its value) and possibly leaving a portion of the spectrum unsold.⁵⁷⁸
- iii. spectrum being sold at a price which no longer ensures its optimal use or represents poor value in the procurement of coverage (i.e. reduced competition from a limited field of potential suppliers);⁵⁷⁹
- iv. a coverage obligation may need to be bundled with a disproportionately large share of the available spectrum to ensure the obligation can be met and has positive value for at least some bidders, leading to a possible skewed and inefficient distribution of the available spectrum⁵⁸⁰; and
- v. uncertainty about the value of coverage lots could make it difficult to set reserve prices, depriving the auction designer of a useful instrument against gaming and collusion within the proposed spectrum award.⁵⁸¹

A 9.82 In relation to (i), the likely value of the 700 MHz band is small relative to the cost of extending coverage beyond 95%. As noted by DotEcon, benchmarks suggest that it would be unlikely for the market price of a 2x10 MHz block at 700 MHz to exceed €50m.⁵⁸² In contrast, Oxera estimates the cost of extending one mobile network to 99.5% population coverage at 30 Mbit/s to be in the order of €500m or €1.8 billion over a ten year period. Even small coverage increases above 95% could quickly erode the value of the spectrum. For example, and even using historical rollout rates, the cost of extending coverage beyond 97% could exceed the value of unencumbered spectrum.

A 9.83 In relation to (ii) and (iii), the point at which population coverage ceases to

⁵⁷⁶ Ibid, p58

⁵⁷⁷ The reduction in competition arises regardless of the auction format, being ultimately due to the harsh coverage obligation.

⁵⁷⁸ Document 18/103d, 'Coverage obligations and spectrum awards a report from DotEcon Ltd, published November 2018, p 48.

⁵⁷⁹ Ibid, p3

⁵⁸⁰ Ibid.

⁵⁸¹ Ibid.

⁵⁸² Ibid, p47.

be commercially viable is likely to be different for different operators.⁵⁸³ It should be noted that although modelling usefully provides a broadly representative picture of population coverage at a generic network level, in reality, the point at which individual MNOs determine commercial viability is likely to be different. Under Option 4, some, but not all, operators may have a reduced value, or no value at all for 700 MHz rights of use. This would create a risk of spectrum going unsold and/or spectrum being sold to alternative bidders at a price that would not ensure its optimal use because it benefitted from a lack of competition due to a high coverage obligation.

A 9.84 Even where high coverage obligations were assigned to some but not all operators this could create significant distortions to competition downstream. For example, in a three operator market (A, B & C), where Operator A and B are able to meet the coverage obligation⁵⁸⁴ (e.g. 99%) and Operator C is not because the costs of providing that coverage significantly exceed the value of the spectrum to it⁵⁸⁵. Operators A and B would obtain all rights of use (subject to competition caps) while Operator C would obtain no rights of use, when it would likely have done so if the obligation was set at the 90 – 95% level. This would create a significant bifurcation in the market with Operators A and B able to provide significantly improved coverage and speeds. In particular, Operators A and B would be able to increase 30 Mbit/s population coverage to 99% while Operator C would not be able to use 700 MHz spectrum to expand its coverage, when it would have been able to provide 30 Mbit/s population coverage to 95% population if the coverage obligation had been more modest.

A 9.85 In relation to (iv), the coverage obligation could be attached to a larger block of spectrum in order to reduce the costs of providing a high coverage obligation.⁵⁸⁶ However, this could lead to additional competition problems if only one bidder is capable of meeting the obligation, as it could lever its strong position to win additional spectrum it might not otherwise have won,

⁵⁸³ For example:

- an operator might be at an advantage in trying to obtain the coverage lot if it has widespread fixed infrastructure.
- asymmetries might arise because one mobile network operator already has greater coverage or more spectrum than others, reducing the incremental cost of meeting a coverage obligation.

⁵⁸⁴ i.e. because such operators may have a higher coverage level to begin with.

⁵⁸⁵ Such a scenario could arise if the starting point of Operators is different or the commercial plans are somewhat though not significantly different i.e. Operator C may want to provide broad coverage while Operators A and B would prefer expansive coverage.

⁵⁸⁶ As noted in the 'Spectrum for Award' RIA, the construction of base stations deploying more radios and antennas as well as extending additional backhaul links to new sites is expensive. Expanding capacity in this way typically costs several times more than adding additional spectrum to existing base stations.

potentially distorting competition.⁵⁸⁷ As noted by DotEcon, in auctions with package bidding, coverage obligations could create an opportunity for operators willing to exploit their position in competing for the coverage lot to leverage its cost advantage to obtain more spectrum e.g. bidding only for the coverage lot if it is packaged with a large amount of other spectrum.⁵⁸⁸ Such a situation would restrict the ability of ComReg to select an auction format that ensures the efficient use of the radio spectrum more generally. Readers are referred to Chapter 6 where the benefits of package bidding are explained in more detail.

- A 9.86 In relation to (v), spectrum fees for rights for ECS are an important tool by which ComReg can ensure the efficient use of such rights. Efficient spectrum assignment generally requires rights of use to be assigned to those users able to make the best economic use of it, and for the users of the assigned spectrum to make use of it in the way that generates the greatest social benefit. Appropriate spectrum fees can help to establish the efficient assignment of spectrum amongst bidders, based on bidders' willingness to pay and establish the opportunity costs of the assignment, setting suitable spectrum usage fees at a level encourages the winning bidder(s) to utilise the spectrum more efficiently.⁵⁸⁹
- A 9.87 Under Option 4, it would be difficult for ComReg to make an assessment of an appropriate reserve price that accurately reflects the value of the obligation compared to the spectrum (i.e. competitive benchmarks are based on awards without excessive obligations). This is exacerbated to the extent that usage fees, if any, prescribed under Option 4 are unlikely to encourage the licensee to return unused or underused spectrum if they do not reasonably reflect the opportunity cost of the reserved use. As such, under Option 4 long-term competition could be restricted because there is less of an incentive to return the spectrum over the duration of the licence.
- A 9.88 Finally, to the extent that services in the future may require extended connectivity, DotEcon notes that there is a strong argument that it would be better to wait and see what competition between network operators can deliver, subject to a precautionary coverage obligation, and then intervene

⁵⁸⁷ Document 18/103d, 'Coverage obligations and spectrum awards' a report from DotEcon Ltd, published November 2018, p 3.

⁵⁸⁸ Document 18/103d, 'Coverage obligations and spectrum awards' a report from DotEcon Ltd, published November 2018, p 48.

⁵⁸⁹ In the long run, spectrum usage fees (SUFs) serve an important role in ensuring the efficient use of spectrum by incentivising and encouraging the return of unused or underutilised spectrum rights. In order for SUFs to be effective, they should be set at a level that reflects the opportunity cost of holding the spectrum rights. In terms of the SUF, this cannot be known prior to the award (as SUFs are paid at a future date). However, in setting the SUF as a proportion of the minimum price, and ultimately the final price, which would reflect the opportunity cost of the spectrum, the SUF should encourage return of unused or underused spectrum to ComReg.

selectively to address specific, observed coverage failures if and when they emerge.

Preliminary view on Option 4

A 9.89 Therefore, and for the reasons outlined above, ComReg is of the preliminary view that Option 3 would have a more positive impact on competition than Option 4.

Impact on Consumers

A 9.90 The Mobile Consumer Experience Survey⁵⁹⁰ highlighted a number of issues that impact consumer's connectivity experience. In particular,

- the incidence of service issues is higher indoors with circa one third of consumers experiencing service issues indoors in the past month.
- the biggest service issues indoors and outdoors relates to the ability to make a call.⁵⁹¹

A 9.91 ComReg has earlier considered that such issues could be more appropriately dealt with through obligations on licensees in the Proposed Bands that would oblige licensees to (a) enable Native Wi-Fi on its network, under certain conditions within 2 years of licence commencement and (b) provide VoLTE services, under certain conditions within 2 years of licence commencement.⁵⁹² Both of these measures are in addition to the population coverage obligation assessed in this draft RIA.

A 9.92 The remainder of this section is cognisant of service issues experienced by consumers while outdoors. While consumers would prefer widespread coverage their views will primarily relate to the localities where they live, work and travel. In that regard, the Mobile Consumer Experience Survey provides information across five different 'Samples' in different geographic areas of decreasing density (Sample 1 – most dense Sample 5 – least dense). This is helpful to determine service issues and likely views of consumers in different areas. In that regard, ComReg notes that⁵⁹³:

- Samples 1 and 2 covers up to 75% of the population and would cover all urban areas.

⁵⁹⁰ Mobile Consumer Experience Survey 2019, Document 19/101.

⁵⁹¹ Mobile Consumer Experience Survey 2019, Document 19/101 – Slides 87 &90.

⁵⁹² Chapter 7 considers in detail these proposed obligations

⁵⁹³ Ibid, Slide 6.

- Sample 3 approximately covers the next 15% of the population and cover both urban and rural areas.
- Samples 4 and 5 approximately covers the remaining 10 % of the population which would be mostly rural.

Option 1, 2 and 3.

A 9.93 It can be assumed that what is good for competition, and what promotes investment in infrastructure, is, in general, good for consumers. This is because increased competition between operators brings benefits to their customers in terms of price, choice and quality of services. Therefore, options that are preferred for competition above are likely to be preferred by consumers. For example, the distortions to competition discussed earlier (tacit collusion and/or cherry picking) could have important impacts on consumers as coverage would be lower / of poorer quality than would have been the case under effective competition. Given that MNOs already provide coverage to around 97% of the population, consumers would prefer options that best provide for the upgrade of existing services to 30 Mbit/s.

A 9.94 Under Option 1, there is no minimum level of coverage an operator would need to provide and the distortions to competition described above could reduce service provision in certain areas. While urban areas are likely to be covered regardless of any coverage obligation, consumers in these areas also experience service issues (though at a lower level than rural areas). For example, data usage is the only service where urban areas (Samples 1 and 2) have similar levels of service issues than rural areas (Samples 4 and 5).⁵⁹⁴ This likely relates to the increased load on the network in certain urban areas due to higher population densities. Such areas are likely to benefit from a 30 Mbit/s obligation which utilises additional spectrum and carrier aggregation to improve the QoS associated with data usage.

A 9.95 For areas outside of the main towns and cities (e.g. Samples 4 and 5) service issues occur regardless of location. The impact of QoS 'cherry picking' could be particularly high in these areas occurring across a relatively wide area. For example, the 5 cities and suburbs account for a third of the population (covering 1% of area), while 70% of the population is located in towns with greater than 50 households (covering 3% of area).⁵⁹⁵

⁵⁹⁴ Of respondents who experienced services issues in another location 24% and 30% of respondents cited reasons related to data usage in samples 1 & 2, compared to 30% in Sample 5. See Slide 82.

⁵⁹⁵ In Census 2016, 63% of the population is located in urban areas. Urban areas are defined as areas where the population in the **Aggregate Town Area** (defined as those persons living in population clusters) is 1,500 or more inhabitants. For this purpose a **town** with a legally defined boundary is classified on the basis of its total population including any suburbs or environs.

An operator may decide only to provide higher speed services (30 Mbit/s and above) in high density areas or choose to differentiate itself as a provider with an extensive network footprint or alternatively provide higher speed services in urban areas and basic services on a national basis. Separately, a new entrant may decide to cherry pick urban areas only or expand into rural areas at a much slower rate, or not at all. This could result in a sub-optimal outcome with some consumers receiving a high speed service (30 Mbit/s) in urban areas with the remainder of the population receiving an inferior service (3 Mbit/s).

- A 9.96 All consumers but particularly rural consumers also have service issues when travelling in a car or bus and/or while visiting other locations away from the home. For example, all samples experienced a loss of signal (or no/poor signal/coverage) while in another location or when travelling in a car/bus for voice call and texts (32%). However, such service issues were highest in the most rural samples, Samples 4 and 5 (46% - 55%)⁵⁹⁶. If 30 Mbit/s coverage is targeted in urban areas only, the provision of 30 Mbit/s coverage on terrestrial routes would be similarly impacted where a lower speed service may be deemed sufficient by MNOs. Because population coverage by its nature leads to incidental coverage of roads, lower population coverage would lead to reduced road coverage. In particular, while most of the population lives in urban areas most of the road network is located in rural areas and QoS 'cherry picking' or other distortions (e.g. tacit collusion) that reduce coverage would severely limit the rollout of high-speed services on terrestrial routes.
- A 9.97 As previously noted, such distortions are less likely to arise under Option 2 (particularly at the higher end of the range) compared with Option 1. However, even under Option 2, there would remain areas where coverage would normally be provided, that could be avoided through a tacit understanding. This would be more likely to occur in respect of rural areas given the relatively higher avoided costs of not providing coverage to those areas. In particular, the areas most likely not to be covered in such a scenario would be the most rural areas (i.e. the last 10% of population – Samples 4 and 5).
- A 9.98 Alternatively, Option 3 would oblige operators to provide coverage that is sufficiently close to what would be expected to be delivered under effective competition. While MNOs would be able to provide coverage above these levels all MNOs would be obliged to serve this level of population at a minimum. Consumers are therefore likely to favour Option 3 over Option 2 since it minimises the risks of the above distortions associated with Option

⁵⁹⁶ Mobile Consumer Experience Survey 2019, Document 19/101 – Slide 79.

2.

A 9.99 Finally, while the last 5% of the population would not likely benefit from a 30 Mbit/s mobile service under Option 3, the provision of 30 Mbit/s to 95% of the population would result in incidental coverage that would provide some benefits to the last 5% of the population. For example:

- 99% of Ireland's population would receive incidental coverage of at least 3 Mbit/s; and
- 99% of primary roads and motorways would receive incidental coverage of at least 3 Mbit/s proving basic connectivity on transport routes.

A 9.100 Furthermore, the rollout of the National Broadband Plan will provide the ability to access high-speed internet indoors to all households and the rollout of native Wi-Fi will provide for mobile calls to be received indoors.

Option 4

A 9.101 Consumers would likely prefer a coverage obligation that maximises the extent to which operators provide coverage across the widest possible area. Consumers may therefore, on first impressions, prefer Option 4 as this provides for a high rollout obligation across the widest possible area and would likely be in excess of levels delivered commercially.

A 9.102 However, while any winning bidder would be obliged to provide additional coverage, overall consumer welfare is unlikely to be improved for a number of reasons.

- Under Option 4, it is very costly to reach the last 5% of the population which could reduce overall consumer welfare in a number of ways, including:
 - diverting investment away from providing connectivity in areas where people work and travel towards areas where few people live.
 - likely increasing the price of mobile services, noting that for a rollout period of ten years the total cost would be €1.8 billion to serve 99.5% of the population⁵⁹⁷. In that regard, it should be

⁵⁹⁷ In order to compare costs across comparable periods Oxera uses a 8.04% rollout rate (over a ten year period) which corresponds to a new site every two days or three upgrades per day.

recalled that consumers have a low willingness to pay for additional coverage.⁵⁹⁸

- that the cost of coverage would fall disproportionately on consumers who would not benefit from the increased obligation (i.e. prices would increase across all subscribers⁵⁹⁹).
- It would be unlikely to address the provision of coverage where people work outside residential areas or along transport corridors. For example, increasing motorway coverage from 90% to 99.5% would have a similar cost compared to increasing population from 95% to 97% but would likely benefit more consumers.
- There is no guarantee that any operator would be willing to bid for 700 MHz rights of use with obligations that would run the risk of going beyond what would be provided under effective competition. As noted previously, the cost of providing additional coverage is large relative to the likely value of the spectrum. The consumer harm arising from 700 MHz rights of use not being assigned or delayed would be significant for all consumers including:
 - The large number (1,200) of upgrades at sites that would otherwise occur⁶⁰⁰, that would allow for 30 Mbit/s to be provided in more rural areas more cheaply would be delayed or not provided.
 - 30 Mbit/s would only be provided in more urban areas while rural areas would continue to be provided with a lower speed service.
 - In that regard, ComReg notes the view of LS telcom and the importance of the 700 MHz Duplex for 5G services and for rural connectivity in Ireland⁶⁰¹
- Any increased coverage would only be delivered over a very long period compared to the consumer harm which would be more immediate. The base case assumption in the model is that the MNO builds new sites at a CAGR of 2.5% (which Oxera consider feasible for

⁵⁹⁸ In the Mobile Consumer Experience Survey 2017, the average willingness to pay for coverage throughout all of their home for consumers without a reliable service was on average €2.17 extra for calls/texts and €1.98 for data.

⁵⁹⁹ As noted by DotEcon (Document 18/103d), only a small fraction of consumers will directly benefit from the incremental coverage and might use services when in the newly covered area. The MNO needs to raise prices slightly for all customers to extract any of the additional value created by its greater coverage footprint, which means it will potentially lose some customers who do not value the additional coverage.

⁶⁰⁰ Noting that many new features/technologies are added to ETSI/3GPP standards over time and included in the latest equipment from equipment vendors including carrier aggregation in sub 1 GHz bands.

⁶⁰¹ See Annex 3 – Document 19/59.

an MNO to achieve). At this roll-out speed, 99.5% population coverage for 30 Mbit/s would only be achieved in the year 2042 and corresponds to a new site every week.

A 9.103 Therefore, and for the reasons outlined above, ComReg is of the preliminary view that Option 3 would have a more positive impact on consumers than Option 4.

The 'Coverage RIA: Assessment and the Preferred Option (Step 5)

A 9.104 In light of the above assessment, ComReg is of the preliminary view that more than one preferred option may be necessary to account for the particular circumstances that might arise in the Proposed Award. In particular, an obligation suitable for incumbent MNOs would likely be excessive for new entrants. In that regard, ComReg is of the preliminary view that preferred options are required for:

- Existing MNOs; and
- New Entrants.

A 9.105 In light of the above discussion, ComReg is of the preliminary view that Option 3 is the preferred option for existing MNOs and Option 2 is the preferred option for new entrants.

A 9.106 Chapter 7 (Licence conditions) provides further details on the specifics of each proposed coverage obligation and the associated rollout timelines.

Annex: 10 Outdoor coverage obligations at specific locations

Introduction

A 10.1 In Chapter 7, ComReg proposes to attach coverage obligations to 700 MHz rights of use. One specific obligation is to provide an **outdoor 30 Mbit/s single user throughput obligation in specific locations in the following categories:**

- **Business and Technology Parks:** the IDA provides a list of 31 Business and Technology Parks and 9 Strategic Sites, absent other official sources, these locations are used to identify the locations of business and technology parks. The obligation thus includes adjacent business and technology parks to those of the IDA.
- **Hospitals:** the Health Service Executive (HSE) provides a list of 48 public hospitals and 17 private hospitals
- **Higher Education Campuses:** the Higher Education Authority (HEA) provides a list of 8 Universities, 11 Institutes of Technology and 5 Other Colleges.
- **Ports (Air and Sea):** The Department of Transport, Tourism and Sports (DTTAS) provides a list of 7 airports and the Irish Maritime Development Office (IMDO) provides a list of 7 passenger seaports.
- **Principal Bus Stations:** Bus Éireann provides a list of the main 16 bus stations.
- **Train Stations:** The National Transport Authority (NTA) provides a list of 144 train stations.
- **Visitor Attractions – Information Centre:** Fáilte Ireland provides a list of the top 21 fee charging and top 21 free of charge visitor attractions⁶⁰².

A 10.2 This annex provides additional detail on the specific locations, in particular

- the names, locations and sources of the data informing the specific locations; and

⁶⁰² By visitor numbers in 2017.

- details on how to access the geographic coordinates representing the boundaries of the specific locations (“Boundary Files”).

Detail of the Specific location categories (including names, locations and sources)

Business and Technology Parks

- A 10.3 ComReg has further clarified, the obligation relating to the specific locations for the business and technology parks. ComReg in Document 19/59R identified the IDA⁶⁰³ as being the relevant competent authority to identify the business and technology parks. ComReg notes that absent other official sources on other business and technology parks in the State, the IDA locations are used to identify these locations.
- A 10.4 Specifically, ComReg proposes to include adjacent business and technology parks to those of the IDA, while aiming to exclude large green areas that have no development.
- A 10.5 The coverage obligation (as identified in the Boundary Files) apply to the outdoor areas around buildings, and adjacent carparks and thorough fares within, as well as adjacent to IDA Business and Technology Parks and Strategic Sites.
- A 10.6 Table 15 below contains a list of the IDA Business and Technology Parks and strategic sites.

Table 15: IDA Business and Technology Parks including Strategic Sites

Business and Location Technology Parks		Business and Location Technology Parks	
IDA Business and Technology Park			
1. Dublin/East - College Park Dublin	College Park, Dublin	17. South East - Clonmel Business & Technology Park	Ballingarrane, Clonmel, Tipperary
2. Dublin/East - Grange Castle Business Park	Grange Castle, Dublin	18. South East - Dungarvan Business & Technology Park	Lisfennel, Dungarvan, Waterford
3. Mid East - Arklow Business & Technology Park	Ballynattin, Arklow, Wicklow	19. South East - Kilkenny Business & Technology Park	Loughboy, Kilkenny
4. Mid East - Navan Business & Technology Park	Athlumney, Navan, Meath	20. South East - Waterford Business & Technology Park, Butlerstown	Butlerstown, Waterford

⁶⁰³ <https://www.idaireland.com/>

Business and Location Technology Parks		Business and Location Technology Parks	
5. Mid West - National Technology Park (NTP), Limerick	Plassey, Limerick	21. South East - Wexford Business & Technology Park	Sinnottstown, Wexford
6. Midlands - Athlone Business & Technology Park	Dublin Road, Athlone, Westmeath	22. South West - Carrigtwohill Business & Technology Park	Carrigtwohill, Cork
7. Midlands - Mullingar Business & Technology Park	Ardmore, Mullingar, Westmeath	23. South West - Cork Business & Technology Park	Model Farm Road, Cork
8. Midlands - Portlaoise Business & Technology Park	Mounrath Road, Portlaoise, Laois	24. South West - Fermoy Business & Technology Park	Fermoy, Cork
9. Midlands - Tullamore Business & Technology Park	Srah, Tullamore, Offaly	25. South West - Kerry Technology Park	Tralee, Kerry
10. North East - Cavan Business & Technology Park	Killygarry, Cavan	26. South West - Kilbarry Business & Technology Park	Kilbarry, Cork
11. North East - Drogheda Business & Technology Park	Donore Road, Drogheda, Louth	27. West - Ballinasloe Business & Technology Park	Roscommon Road, Ballinasloe, Galway
12. North East - Dundalk Business & Technology Park	Finnabair, Dundalk, Louth	28. West - Castlebar Business & Technology Park	Drumconlan, Castlebar, Mayo
13. North East - Monaghan Business & Technology Park	Knockaconny Monaghan	29. West - Galway Business & Technology Park	Parkmore, Galway
14. North West - Carrick on Shannon Business & Technology Park	Keenaghan, Carrick-on-Shannon, Leitrim	30. West - Roscommon Business & Technology Park	Gallowstown, Roscommon
15. North West - Letterkenny Business & Technology Park	Lisnennan, Letterkenny, Donegal	31. West - Tuam Business & Technology Park	Dunmore Road, Tuam, Galway
16. North West - Sligo Business & Technology Park	Finisklin, Sligo		
IDA Strategic Site			
1. Mid East - Strategic Site Greystones	Charlesland, Greystones, Wicklow	6. South West - Strategic Site Carrigtwohill	Ballyadam, Carrigtwohill, Cork
2. Mid West - Strategic Site on the National Technology Park, Limerick	Plassey, Limerick	7. South West - Strategic Site Ringaskiddy, County Cork	Ringaskiddy, Cork
3. Mid West - Strategic Site, Raheen Business Park, Limerick	Raheen Business Park, Limerick	8. West - Strategic Site Athenry	Athenry, Galway
4. North East - Strategic Site Dundalk - Dundalk Science & Technology Park	Mullagharlin, Dundalk, Louth	9. West - Strategic Site Oranmore	Oranmore, Galway
5. South East - Strategic Site, Belview, Co. Kilkenny	Belview, Waterford Port, Kilkenny/Waterford		

Source: IDA, <https://www.idaireland.com/how-we-help/property>.

Hospitals

A 10.7 Table 16 below contains a list of public and private hospitals obtained from the HSE. Where a hospital is located in more than one location, the coverage obligations apply to each of these locations.

A 10.8 The coverage obligations apply to the hospital's buildings, adjacent car parks and key thorough fares.

Table 16: Public and Private Hospitals

Hospitals	Location	Hospitals	Location
Public Hospital			
1. Bantry General Hospital	Cork	25. National Maternity Hospitals, Holles Street	Dublin
2. Beaumont Hospital	Dublin	26. Nenagh Hospital: UL Hospitals	Tipperary
3. Cappagh National Orthopaedic Hospital	Dublin	27. Our Lady Of Lourdes Hospital, Drogheda	Louth
4. Cavan Monaghan Hospital	Cavan, Monaghan	28. Our Lady's Hospital, Navan	Meath
5. Children's University Hospital, Temple Street	Dublin	29. Our Lady's Children's Hospital Crumlin	Dublin
6. Connolly Hospital Blanchardstown	Dublin	30. Portiuncula Hospital, Ballinasloe	Galway
7. Coombe Women's Hospital	Dublin	31. Roscommon County Hospital	Roscommon
8. Cork University Hospital	Cork	32. Rotunda Hospital	Dublin
9. Cork University Maternity Hospital	Cork	33. Royal Victoria Eye & Ear Hospital, Dublin	Dublin
10. Croom Hospital: UL Hospitals	Limerick	34. Sligo General Hospital	Sligo
11. Ennis Hospital: UL Hospitals	Clare	35. South Infirmary-Victoria Hospital, Cork	Cork
12. Galway University Hospitals	Galway	36. South Tipperary General Hospital	Tipperary
13. Kerry General Hospital	Kerry	37. St Columcille's Hospital, Loughlinstown	Dublin
14. Letterkenny University Hospital	Donegal	38. St James's Hospital	Dublin
15. Lourdes Orthopaedic Hospital, Kilcreene	Kilkenny	39. St John's Hospital Limerick	Limerick
16. Louth County Hospital, Dundalk	Louth	40. St Luke's General Hospital Carlow / Kilkenny	Kilkenny
17. Mallow General	Cork	41. St Luke's Hospital, Rathgar (Cancer Services)	Dublin
18. Mater Misericordiae University Hospital	Dublin	42. St Michael's, Dun Laoghaire	Dublin
19. Mayo General Hospital	Mayo	43. St Vincent's University Hospital, Elm Park	Dublin
20. Mercy University Hospital, Cork	Cork	44. Tallaght Hospital	Dublin

Hospitals	Location	Hospitals	Location
21. Midland Regional Hospital Mullingar	Westmeath	45. University Hospital Limerick	Limerick
22. Midland Regional Hospital Portlaoise	Laois	46. University Maternity Hospital: UL Hospitals	Limerick
23. Midland Regional Hospital Tullamore	Offaly	47. University Hospital Waterford	Waterford
24. Naas General Hospital	Kildare	48. Wexford General Hospital	Wexford
Private Hospital			
1. Aut Even Hospital	Kilkenny	10. Mount Carmel Hospital	Dublin
2. Barringtons Hospital	Limerick	11. Mater Private Hospital	Dublin, Cork
3. Beacon Hospital	Dublin	12. St. Joseph's Hospital	Sligo
4. Blackrock Clinic	Dublin	13. St John of God Hospital	Dublin
5. Bon Secours Health System	Cork, Dublin, Galway, Kerry	14. St Patrick's University Hospital	Dublin
6. Clane General Hospital	Kildare	15. St Vincent's Private Hospital	Dublin
7. Galway Clinic	Galway	16. Sports Surgery Clinic	Dublin
8. Hermitage Medical Centre	Dublin	17. Whitfield Clinic	Waterford
9. Highfield Healthcare	Dublin		

Source: HSE, <https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/hospitallist.html>,
<https://www.hse.ie/eng/services/list/1/schemes/cbd/acchealthcareireland/>.

Higher Education Campuses

A 10.9 Table 17 below contains a list of higher education institutions encompassing: universities, institutes of technology and other colleges as identified by the HEA. Where an institution is located in more than one location, the coverage obligations apply to each of these locations.

A 10.10 The coverage obligations apply to the institution's buildings (including accommodation), adjacent carparks and key thoroughfares

Table 17: Higher Education Campuses

Higher Education Institution	Location	Higher Education Institution	Location
University			
1. Dublin City University	Dublin	5. Trinity College Dublin	Dublin
2. University College Cork	Cork	6. University College Dublin	Dublin
3. National University of Ireland, Galway	Galway	7. University of Limerick	Limerick
4. Maynooth University - Kildare	Kildare	8. TU Dublin	Dublin
Institute of Technology			
1. Athlone Institute of Technology	Westmeath	7. Institute of Technology Sligo	Sligo
2. Cork Institute of Technology	Cork	8. Institute of Technology Tralee	Kerry
3. Dun Laoghaire Institute of Art and Design	Dublin	9. Letterkenny Institute of Technology	Donegal
4. Dundalk Institute of Technology	Louth	10. Limerick Institute of Technology	Limerick
5. Galway-Mayo Institute of Technology	Galway	11. Waterford Institute of Technology	Waterford
6. Institute of Technology Carlow	Carlow		
Other College			
1. Royal College of Surgeons in Ireland	Dublin	4. National College of Art and Design	Dublin
2. Royal Irish Academy	Dublin	5. Mary Immaculate College	Limerick
3. St Angela's College	Sligo		

Source: HEA, <http://hea.ie/higher-education-institutions/?v=l>.

Ports (Air and Sea)

A 10.11 Table 18 below contains a list of passenger focussed transport provided by airports and seaports. The list of airports was obtained from the DTTS, and the list of passenger seaports was obtained from the IMDO. Where a port as listed below contains more than one location, the coverage obligations apply to each of these locations as detailed in the Specific Location Boundary Files. For airports, the coverage obligations apply to areas where passengers will be waiting, embarking or disembarking, adjacent short term car parks and key passenger thorough fares.

A 10.12 For passenger seaports, the coverage obligations apply to areas where passengers will be waiting, embarking or disembarking, adjacent car parks and key passenger thorough fares.

Table 18 Ports (Air and Sea)

Ports	Location	Ports	Location
Airport			
1. Dublin Airport	Dublin	5. Ireland West Airport Knock	Mayo
2. Cork Airport	Cork	6. Kerry Airport	Kerry
3. Shannon Airport	Clare	7. Waterford Airport	Waterford
4. Donegal Airport	Donegal		
Passenger Seaport			
1. Bantry Bay Port Company	Cork	5. Port of Galway	Galway
2. Dublin Port Company	Dublin	6. Rosslare Europort	Wexford
3. Dun Laoghaire Port Company	Dublin	7. Port of Waterford	Waterford
4. Port of Cork	Cork		

Source: DTTS, <http://www.dttas.ie/aviation/airports>; IMDO, <http://www.dttas.ie/aviation/airports>

Principal Bus Stations

A 10.13 Table 19 below contains a list of Bus Éireann's 16 principal bus stations which also include information offices.

A 10.14 The outdoor coverage obligations apply to areas where passengers will be waiting, embarking or disembarking, and adjacent carparks.

Table 19: Principal Bus Stations

Bus Station	Location	Bus Station	Location
1. Athlone	Southern Station Road, Athlone	9. Galway	Ceannt Station, Eyre Square, Galway
2. Ballina	Kevin Barry Street, Ballina	10. Killarney	Fairhill, Killarney
3. Cavan	Farnham Street, Cavan	11. Letterkenny	Port Road, Letterkenny
4. Cork	Parnell Place, Cork	12. Limerick	Colbert Station, Parnell Street, Limerick
5. Drogheda	Donore Road, Drogheda	13. Monaghan	North Road, Monaghan
6. Dundalk	Long Walk, Dundalk	14. Sligo	Lord Edward Street, Sligo
7. Dublin	Busáras Central Station, Store Street, Dublin	15. Tralee	Casement Station, Tralee
8. Ennis	Clonroad More, Ennis	16. Waterford	The Quay, Waterford

Source: Bus Éireann, <https://www.buseireann.ie/pdf/1473240111-Network-Map.pdf>

Train Stations

A 10.15 Table 20 below contains a list of 144 train stations by descending passenger numbers⁶⁰⁴ as obtained from the NTA.

A 10.16 The outdoor coverage obligations apply to each station including areas where passengers will be waiting, embarking or disembarking (platforms), and adjacent carparks.

Table 20: Train Stations

Train Station	Location	Train Station	Location
1. Connolly	Dublin	73. M3 Parkway	Dublin
2. Pearse	Dublin	74. Sligo	Sligo
3. Heuston	Kildare	75. Longford	Longford
4. Tara Street	Dublin	76. Killarney	Kerry
5. Grand Canal Dock	Dublin	77. Kilcock	Kildare
6. Dun Laoghaire	Dublin	78. Dunboyne	Meath
7. Cork	Cork	79. Adamstown	Dublin
8. Bray	Dublin	80. Glounthaune	Cork
9. Lansdowne	Dublin	81. Navan Road Parkway	Dublin
10. Malahide	Dublin	82. Wicklow	Wicklow
11. Maynooth	Kildare	83. Tralee	Kerry
12. Blackrock	Dublin	84. Waterford	Waterford
13. Greystones	Dublin	85. Manulla Junction	Mayo
14. Sydney Parade	Dublin	86. Enfield	Meath
15. Coolmine	Dublin	87. Ennis	Clare
16. Balbriggan	Dublin	88. Ballinasloe	Galway
17. Howth Junction and Donaghmede	Dublin	89. Hansfield	Dublin
18. Raheny	Dublin	90. Oranmore	Galway
19. Clontarf Rd	Dublin	91. Wexford	Wexford
20. Portmarnock	Dublin	92. Castlebar	Mayo
21. Limerick Junction	Tipperary	93. Clondalkin Fonthill	Dublin
22. Galway	Galway	94. Ballybrophy	Laois
23. Dalkey	Dublin	95. Carrick-on-Shannon	Leitrim
24. Docklands	Dublin	96. Muine Bheag	Carlow
25. Glenageary	Dublin	97. Edgeworthstown	Longford
26. Booterstown	Dublin	98. Carrigtwohill	Cork
27. Sallins and Naas	Kildare	99. Arklow	Wicklow
28. Skerries	Dublin	100. Clara	Offaly
29. Drumcondra	Dublin	101. Roscommon	Roscommon
30. Clonsilla	Dublin	102. Westport	Mayo

⁶⁰⁴ By number of passengers boarding and alighting on 16 November 2017 as published in NTA's 'National Heavy Rail Census Report 2017'

Train Station	Location	Train Station	Location
31. Kilbarrack	Dublin	103.Gorey	Wexford
32. Howth	Dublin	104.Dromod	Leitrim
33. Mallow	Cork	105.Gormanston	Meath
34. Bayside	Dublin	106.Monasterevin	Kildare
35. Donabate	Dublin	107.Kilcoole	Wicklow
36. Newbridge	Kildare	108.Ballymote	Sligo
37. Shankill	Dublin	109.Ballina	Mayo
38. Harmonstown	Dublin	110.Boyle	Roscommon
39. Salthill and Monkstown	Dublin	111.Charleville	Cork
40. Clongriffin	Dublin	112.Templemore	Tipperary
41. Sandycove and Glasthule	Dublin	113.Claremorris	Mayo
42. Limerick	Limerick	114.Ballyhaunis	Mayo
43. Drogheda	Louth	115.Millstreet	Cork
44. Killester	Dublin	116.Enniscorthy	Wexford
45. Sandymount	Dublin	117.Rushbrooke	Cork
46. Ashtown	Dublin	118.Castlerea	Roscommon
47. Portlaoise	Laois	119.Collooney	Sligo
48. Leixlip Louisa Bridge	Kildare	120.Rathdrum	Dublin
49. Killiney	Dublin	121.Woodlawn	Galway
50. Sutton	Dublin	122.Thomastown	Kilkenny
51. Castleknock	Dublin	123.Sixmilebridge	Clare
52. Rush and Lusk	Dublin	124.Rathmore	Kerry
53. Kildare	Kildare	125.Banteer	Cork
54. Athlone	Westmeath	126.Nenagh	Tipperary
55. Seapoint	Dublin	127.Craughwell	Galway
56. Carlow	Carlow	128.Carrigaloe	Cork
57. Portarlinton	Laois	129.Farranfore	Kerry
58. Leixlip Confey	Kildare	130.Clonmel	Tipperary
59. Thurles	Tipperary	131.Fota	Cork
60. Tullamore	Offaly	132.Rosslare Strand	Wexford
61. Midleton	Cork	133.Foxford	Mayo
62. Mullingar	Westmeath	134.Roscrea	Tipperary
63. Littleisland	Cork	135.Attymon	Galway
64. Dundalk	Louth	136.Gort	Galway
65. Hazelhatch and Celbridge	Kildare	137.Rosslare Euro Port	Wexford
66. Broombridge	Dublin	138.Castleconnell	Limerick
67. Cobh	Cork	139.Cahir	Tipperary
68. Athenry	Galway	140.Birdhill	Tipperary
69. Kilkenny	Kilkenny	141.Carrick-on- Suir	Tipperary
70. Athy	Kildare	142.Ardrahan	Galway
71. Parkwest and Cherry Orchard	Dublin	143.Cloughjordan	Tipperary
72. Laytown	Meath	144.Tipperary	Tipperary

Source: National Transport Authority, 'National Heavy Rail Census Report 2017', published July 2018, https://www.nationaltransport.ie/wp-content/uploads/2018/08/National_Heavy_Rail_2018_V8_Web.pdf

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Visitor Attractions - Information Centre

A 10.17 Table 21 below contains a list of the top 21 visitor attractions (fee charging and free of charge) by visitor numbers in 2017, as obtained from Fáilte Ireland.

A 10.18 The outdoor coverage obligations apply to the information centre at each attraction.

Table 21: Visitor Attraction – Information Centres

Visitor Attraction	Location	Visitor Attraction	Location
Fee Charging			
1. Guinness Storehouse	Dublin	12. Blarney Castle and Gardens	Cork
2. Cliffs of Moher Visitor Experience	Clare	13. Kilmainham Gaol	Dublin
3. Dublin Zoo	Dublin	14. Kilkenny Castle	Kilkenny
4. National Aquatic Centre	Dublin	15. Rock of Cashel	Tipperary
5. Book of Kells	Dublin	16. Dublin Castle	Dublin
6. Tayto Park	Meath	17. Bunratty Castle and Folk Park	Clare
7. St Patrick's Cathedral	Dublin	18. Old Jameson Distillery	Dublin
8. Kylemore Abbey & Gardens	Galway	19. Brú na Bóinne Newgrange	Meath
9. Muckross House Gardens and Traditional Farm	Kerry	20. Christ Church Cathedral	Dublin
10. Powerscourt Gardens and Waterfall	Wicklow	21. Glenveagh Castle and Grounds	Donegal
11. Fota Wildlife Park	Cork		
Free of Charge			
1. National Gallery of Ireland	Dublin	12. National Museum of Ireland - Natural History, Merrion St	Dublin
2. Castletown House Parklands	Kildare	13. Kilkenny Castle Parklands	Kilkenny
3. Glendalough Site	Wicklow	14. Chester Beatty Library	Dublin
4. National Botanic Gardens	Dublin	15. National Museum of Ireland - Decorative Arts and History, Collins Barracks	Dublin
5. DLR Lexicon1	Dublin	16. Connemara National Park	Galway
6. Irish Museum of Modern Art	Dublin	17. The National Library of Ireland	Dublin
7. Doneraile Wildlife Park	Cork	18. Crawford Art Gallery	Cork
8. National Museum of Ireland - Archaeology, Kildare St	Dublin	19. Malin Head Viewing Point	Donegal
9. Science Gallery at Trinity College Dublin	Dublin	20. Dublin City Gallery The Hugh Lane	Dublin
10. Farmleigh	Dublin	21. Sliabh Liag Cliffs	Donegal

Visitor Attraction	Location	Visitor Attraction	Location
11. Newbridge Silverware Museum of Style Icons	Kildare		

Source: Fáilte Ireland, 'TOURISM FACTS 2017', published July 2018, http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/5_International_Tourism_Trends/Tourism-Facts-2017_2.pdf?ext=.pdf

Geographic Coordinates

A 10.19 ComReg provides the geographic coordinates for each specific location across the 7 categories on its Proposed Multi Band Spectrum Award webpage⁶⁰⁵.

A 10.20 These coordinates were derived using the following methodology:

- Locations for each of the categories were obtained from the authoritative sources referenced at A1.1.
- Satellite images were obtained for each specific location using google maps.
- Areas encompassed by the outdoor coverage obligations were identified using the criteria tabled below:

Table 22: Criteria (Outdoor coverage at/around)

Category	Criteria (outdoor coverage at/around)
Business and Technology Parks	Buildings, the adjacent carparks and thorough fares within, as well as those adjacent to IDA Business and Technology Parks and Strategic Sites.
Hospitals	Hospital's buildings, adjacent car parks and key thoroughfares.
Higher Education Campuses	Institution's buildings (including accommodation), adjacent carparks and key thoroughfares.
Ports	Airports - areas where passengers will be waiting, embarking or disembarking, adjacent short term car parks and key passenger thoroughfares. Passenger seaports - areas where passengers will be waiting, embarking or disembarking, adjacent car parks and key passenger thorough fares.
Principal Bus Stations	Areas where passengers will be waiting, embarking or disembarking, and adjacent carparks.
Train Stations	Areas where passengers will be waiting, embarking or disembarking (platforms), and adjacent carparks
Visitor Attractions – Visitor Centre	Visitor Centre

⁶⁰⁵ <https://www.comreg.ie/industry/radio-spectrum/spectrum-awards/proposed-multi-band-spectrum-award/>

- Coordinates for the identified areas were mapped using visuals from the satellite images and QGIS. Due to the angle from which the satellite images may have been projected, the coordinates may vary slightly from the actual coordinates (e.g. mapped boundaries produced by the coordinates may vary from the actual physical boundaries)
- The coordinates for the each location included in the coverage obligations can be downloaded in .shp or shape files from <https://www.comreg.ie/industry/radio-spectrum/spectrum-awards/proposed-multi-band-spectrum-award/>.

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Annex: 11 Draft Rollout RIA – Performance Bands

Introduction

A 11.1 This Annex sets out an updated version of ComReg’s draft Base Station ‘Rollout’ RIA for rights of use in the 2.1 GHz Band, 2.3 GHz Band and 2.6 GHz Band⁶⁰⁶ (the “Performance Bands”⁶⁰⁷) and considers what obligation(s) (if any) should be set for each of the bands.

RIA Framework

A 11.2 The purpose, structure and scope of the RIA framework are discussed at the beginning of the draft ‘Spectrum for Award’ RIA which is contained in Annex 6.

Policy issues and identify the objectives (Step 1)

Policy Issues

A 11.3 In the context of this RIA, the policy issue to be addressed is to determine what coverage or rollout obligations (if any) are appropriate for the Performance Bands.

A 11.4 In considering this policy issue, there are a number of objectives which ComReg must balance. Operators issued with new rights of use in the Performance Bands could potentially not use those licences to roll out services across an acceptable area in a timely manner, and that this would not be in the interests of consumers or an efficient use of the radio spectrum. This could justify the attachment of rollout obligations to those licences. In contrast, the imposition of overly onerous obligations could have negative consequences such as requiring unnecessary and therefore inefficient investment in infrastructure or even discouraging participation in the Proposed Award by parties who would otherwise efficiently deploy services.

A 11.5 Accordingly, the policy issue for ComReg is to determine whether a rollout obligation(s) would be appropriate and, if so, identify an appropriate

⁶⁰⁶ The original version was published as Annex 9 to Document 19/59R.

⁶⁰⁷ As noted in the draft ‘Spectrum for Award’ RIA these bands are typically used for capacity on mobile networks but provide coverage and capacity for fixed wireless networks. This defined term does not indicate a view of the ‘performance’ of these bands in a particular area, or for a particular purpose.

obligation(s) which would ensure a reasonable level of rollout without significantly discouraging participation in the Proposed Award.

Objectives

A 11.6 In considering the above policy issue, ComReg is guided by what it considers to be the most relevant of its statutory objectives, including:

- assigning rights of use in the 2.1 GHz band in line with the 2.1 GHz EC Decision and other relevant legislation;
- assigning rights of use in the 2.6 GHz band in line with the 2.6 GHz EC Decision and other relevant legislation;
- to ensure that all end users, including disabled users, derive maximum benefit in terms of choice, price and quality;
- to encourage the efficient use and ensure the effective management of spectrum; and
- to ensure there is no distortion or restriction of competition in the electronic communications sector.

A 11.7 ComReg is also mindful of the “connectivity” general objective (and related recitals) in the EECC:

- “Promoting connectivity and access to, and take-up of, **very high capacity networks**, including fixed, mobile and wireless networks, by all citizens and businesses of the Union” (Article 3(2)(a) – **emphasis added**); and
- where “...that connectivity objective translates, on the one hand, into aiming for the highest capacity networks and services economically sustainable in a given area, and, on the other, into pursuing territorial cohesion, in the sense of convergence **in capacity** available in different area” (Recital 23 – **emphasis added**).

A 11.8 ComReg’s overall powers, functions, duties and objectives in relation to the management of the radio frequency spectrum in Ireland are set out in Annex 2.

Identify the regulatory options (step 2)

A 11.9 The background and key questions that are relevant and inform the establishment of the options are set out in Chapter 8 (of Document 19/59R) and ComReg does not propose to set them out again here. However, in

summary, ComReg is of the preliminary view that :

- the main potential uses of the Performance Bands are for mobile services, small cells and fixed wireless services;
- a rollout obligation linked to a base station obligation would be more appropriate for the Performance Bands in this award, and;
- if an obligation is deemed necessary, that an asymmetric obligation (i.e. different obligation depending on users) would likely be required for the Performance Bands such that:
 - a mobile and non-mobile coverage obligation should be provided for each Performance Band;
 - compared to existing operators⁶⁰⁸, new entrants who have no existing network in place should be subject to a less onerous obligation across all bands; and
 - existing 2.1 GHz Licensees should be subject to a higher rollout obligation for that band given existing rollout (and consequently already being in a position to meet a coverage condition close to existing rollout).

Regulatory options

A 11.10 In light of the above, ComReg considers that the following regulatory options are potentially available. As elaborated further below, a mixture of options may be appropriate depending on how the spectrum is used (i.e. mobile or non-mobile) and by whom (i.e. incumbent or new entrant).

- **Option 1:** Impose no rollout obligation.
 - This would mean that each licensee would have full flexibility to choose how extensive their rollout would be regardless of the amount of spectrum rights of use assigned to it.
 - An operator could choose to provide no services, only to provide services in high density areas, or choose to differentiate itself as a provider with an extensive network footprint.

⁶⁰⁸ Existing operators refers to the existing licensees in the 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz bands, noting that these operators already have rolled out existing networks/infrastructure in this bands.

- **Option 2:** Impose a rollout obligation, with a rollout period of 3⁶⁰⁹- 5⁶¹⁰ years for 80 - 500 network controlled base stations.
 - The lower end of this range of base stations is informed by the base station rollout obligation used in the 3.6 GHz Award in Ireland.⁶¹¹
 - The upper end of this range is informed by the proposals in the 3.4-3.8 GHz award in Austria (2019).⁶¹²
 - Under this Option, ComReg proposes to set the obligation at a minimum of **290 base stations** (i.e. the mid – point of the range) but may set the obligation in the lower or higher end of the range depending on any additional information it receives.
 - ComReg notes that in response to Document 19/59R, it has not received any additional information that would cause it to set the obligation at a higher or lower point of the range (See Chapter 7).
- **Option 3:** Impose a rollout obligation, with a rollout period of 3 – 5 years for 500 – 1,200 network controlled base stations.
 - The upper end of this range is informed by Three's existing rollout of the 1800 MHz Band to over 1,200 base stations. However, ComReg notes that part of this rollout may relate to legacy GSM services and may not therefore be reflective of an efficient 4G/5G rollout.
 - Under this Option, ComReg proposes to set the obligation at **525 base stations** (i.e. the median⁶¹³ of the existing 1800 MHz rollout) but may set it lower or higher in the range depending on any additional information or advice it receives.

⁶⁰⁹ ComReg notes that the Oxera Report (Document 18/103c) advised that for existing MNOs the standard network upgrade could be provided every two days over a 3 year period (i.e. 550 upgrades). This rollout period is sufficient to cover the suggested rollout in Options 1, 2 and 3. Option 4 refers to the 2.1 GHz Band which has already rolled out to these levels.

⁶¹⁰ This takes into account the longer rollout period that would be required for new entrants.

⁶¹¹ In that award, if a licensee obtained rights of use up to 100 MHz across all of the regions, then the rollout obligation would be 78 base stations.

⁶¹² ComReg proposes that the upper range of Option 2 be 500 base stations; approximately half of the obligation attached to National licences in the Austrian award. The population of Austria is approximately 8.86 million (2019) and the population density stands at approximately 106 people/km². The population of Ireland is approximately 4.7 million (2016) while the population density is 70 people/km².

⁶¹³ Given the existing rollout, the median is a better measure of the central tendency as it is not skewed by high Three rollout, including existing GSM which is less relevant.

- ComReg notes that in response to Document 19/59R, it has not received any additional information that would cause it to set the obligation at a higher or lower point of the range. (See Chapter 7)
- **Option 4:** Impose a rollout obligation, with a rollout period of 3 - 5 years for 1,200 – 1,900 network controlled base stations.
 - The upper end of this range is informed by Three's rollout in the 2.1 GHz Band.
 - The 2.1 GHz Band was the only band licensed to provide 3G coverage prior to the 2012 MBSA. Site rollout partly reflected the lack of alternative spectrum (particularly spectrum suitable for coverage) with which to rollout 3G services. However, in the intervening period an additional 280 MHz of spectrum has been assigned to MNOs across three different bands (800 MHz, 900 MHz and 1800 MHz).
 - Further, it is proposed to assign an additional 350 MHz in the Proposed Award across three more bands (700 MHz Duplex, 2.3 GHz Band and 2.6 GHz Band). The existing rollout of the 2.1 GHz Band provides useful information on what rollout could be achieved in the future. However, rollout set at these levels may exceed what could be deemed efficient for the rollout of 4G/5G services given the availability of alternative bands (particularly coverage bands) which were not available when UMTS 2100 was first rolled out.
 - Given the above, under this Option, ComReg proposes to set the obligation under Option 4 at **1,200 base stations** (i.e. the lower end of the range) to provide flexibility in the rollout of 4G/5G services but may set it higher in the range depending on any additional information or advice it receives.
 - ComReg notes that in response to Document 19/59R, it has not received any additional information that would cause it to set the obligation at a higher point of the range. (See Chapter 7)
- **Option 5:** Impose a rollout obligation, with a rollout period of 3 – 5 years for over 1,900 network controlled base stations.
 - This option would require base station deployment in excess of network deployment for existing 1800 MHz and 2.1 GHz Bands.
 - This obligation would be aligned with the likely rollout of sub 1 GHz bands.

A 11.11 The following sections of the draft 'Rollout RIA' consider the impact of the aforementioned regulatory options on:

- industry stakeholders (being existing operators and potential new entrants);
- competition; and
- consumers

A 11.12 ComReg notes that it intends to further develop this draft RIA in light of feedback from stakeholders to this consultation.

Impact on industry stakeholders (step 3)

A 11.13 There are a number of key industry stakeholders in relation to the matters considered in this annex:

- Mobile Network Operators (MNOs)
- Other Service Providers (e.g. FWA providers)⁶¹⁴
- Potential new entrants

A 11.14 These are assessed separately under each of the options below. For the purposes of this RIA, ComReg assumes that each operator would likely prefer the rollout obligation that has the least impact on its commercial strategy, particularly if such obligations significantly differ from what it would choose to do independently of any obligation. In that regard, ComReg has considered the responses to Document 19/59R in forming its views on likely rollout. For the purposes of the analysis below, ComReg has assumed that all of the MNOs acquiring rights of use of spectrum in the performance bands would want to use that spectrum for the purposes of mobile. This does not rule out such an MNO using some or all spectrum to provide FWA services, in which case, FWA obligations would be applicable to it in respect of that spectrum.

Option 1 (no rollout)

MNOs/Other Service Providers

A 11.15 Under Option 1, each new licensee would have full flexibility to choose how extensive their network rollout would be and what areas would be covered. A licensee could choose not to rollout any of the Performance Bands on its

⁶¹⁴ ComReg notes that currently Imagine is the only operator offering national fixed wireless services. Other FWA operators are regional, however, ComReg is not discounting the possibility of such operators forming a bidding group in the proposed award and bidding on a national basis.

network, or choose a rollout in line with demand for services. ComReg is of the preliminary view that existing MNOs and Other Service Providers may, on the one hand, prefer that no obligation is imposed but, on the other, that the design of the award does not facilitate speculative bidding⁶¹⁵ or spectrum hoarding⁶¹⁶, either of which could be more likely under Option 1. For example, in response to Document 19/59R, all MNOs appear to agree that some form of rollout is necessary to prevent spectrum hoarding. However, a stakeholder's preference for a rollout obligation to prevent such behaviour would need to be balanced against the desire to have flexibility in providing services in line with its commercial strategy.

A 11.16 For the rest of this section, ComReg divides its assessment of likely MNO preferences in two sections because MNOs already enjoy rights of use in the 2.1 GHz Band:

- i. 'Brownfield Spectrum' where rights of use have already been deployed (i.e. 2.1 GHz Band).
- ii. 'Greenfield Spectrum' where rights of use have not been deployed (i.e. 2.3 GHz Band and 2.6 GHz Band).

New entrants

A 11.17 Potential new entrants are likely to prefer an option with as low a rollout obligation as possible, and therefore Option 1 could be their preferred option, although new entrants would likely be indifferent to obligations that do not go above what they would, in any event, deploy on the basis of their business plans on a commercial basis.

Option 2 (290 base stations)

MNOs

I. 2.1 GHz rollout

A 11.18 In relation to the 2.1 GHz Band, a proposed rollout to 290 base stations would be significantly less than MNOs existing deployment of the band. Further, it would provide MNOs flexibility to scale back the footprint of its existing 2.1 GHz network if the deployment of newly assigned bands was preferred from a network planning perspective.⁶¹⁷ For example, it may be

⁶¹⁵ Speculative bidding refers to bidders attempting to acquire the spectrum at a low price in the hopes that the value will increase in the future and the spectrum can be sold on at a profit.

⁶¹⁶ This is where a rival is assigned spectrum and does not use it denying its use to alternative users

⁶¹⁷ This could also allow MNOs the opportunity to spread investment decisions across a portfolio of spectrum holdings more efficiently, promoting infrastructure based competition.

preferable to use the 700 MHz Band to provide coverage where it previously used the 2.1 GHz Band⁶¹⁸ and this may require the scaling back of certain 2.1 GHz sites across the country (i.e. 3G services were originally provided by 2.1 GHz alone prior to liberalisation of 900 MHz Band and availability of UMTS 900).

A 11.19 Therefore, in relation to the 2.1 GHz Band, MNOs are likely to look favourably at Option 2 because such obligations are significantly below the existing 2.1 GHz deployment and are unlikely to go beyond what MNOs would provide independently.

II. 2.3 GHz and 2.6 GHz rollout

A 11.20 In relation to the 2.3 GHz Band and 2.6 GHz Band, a proposed rollout to 290 base stations under Option 2 would be less than MNOs existing deployment across the 1800 MHz Band (which is used to provide LTE services). Therefore, in relation to the 2.3 GHz Band and 2.6 GHz Band, MNOs are likely to look favourably at Option 2 given the obligations fall below the existing 1800 MHz deployment and are unlikely to go beyond what MNOs would provide independently. Noting also that unlike the 1800 MHz Band, the Performance Bands can be added with a software upgrade rather than an equipment change at some sites, which should reduce the cost of rollout⁶¹⁹.

MNO conclusion on all bands (Option 2)

A 11.21 Therefore, ComReg is of the preliminary view that MNOs are likely to look favourably at Option 2 for all of the Performance Bands.⁶²⁰ For example, in response to Document 19/59R, Three and Eir did not raise objections to the rollout being set at these levels. That said, Vodafone has expressed the view that a rollout obligation set at these levels could be excessive.⁶²¹

⁶¹⁸ Depending on the asset life of the various pieces of equipment, it may be more efficient to add 700 MHz capability to a site rather than installing new 2.1 GHz compatible equipment, noting that equipment is generally not retunable above and below 1 GHz.

⁶¹⁹ As previously noted in the draft 'Spectrum for Award' RIA, base station equipment at some sites are multi-band and cover existing bands such as 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz Band but also cover the 700 MHz Duplex, 2.6 GHz band, and to a lesser extent the 2.3 GHz band.

⁶²⁰ FWA providers would likely prefer a separate and higher rollout obligation if the Performance Bands are used for mobile services reflecting the different network deployment for those services. For example, some respondents to Document 18/60 expressed concern that certain operators might hoard spectrum damaging the FWA sector. In particular, Imagine expressed concern that mobile operators may seek to hoard spectrum leading to a long-term inability to deliver non-mobile services.

⁶²¹ Vodafone suggests that an overall obligation across all bands of 500 would be more appropriate. Since rollout of 290 sites would apply to each Performance Band, Vodafone would only appear to

Notwithstanding Vodafone's contention, ComReg is of the view that Vodafone's assessment of likely rollout seems implausible for reasons stated in Chapter 7 and at the conclusion of this section 'Impact on Stakeholders' below.

Other Service Providers

A 11.22 Other Service Providers (e.g. FWA operators) would likely prefer Option 2 because it would prevent speculative FWA entry and such obligations would likely coincide with any commercial FWA rollout. For example, Imagine proposes to rollout fixed wireless services to rural parts of Ireland with 325 sites⁶²² live by June 2020⁶²³.

A 11.23 Therefore, ComReg is of the preliminary view that Other Service Providers would likely look favourably on Option 2 for all of the Performance Bands.

New entrants

A 11.24 While potential new entrants may prefer Option 1, such entrants would need to rollout a network to some degree, regardless of any obligation, and may prefer some rollout obligation that would be in line with its commercial rollout.

- A mobile entrant is likely to look more favourably on Option 2 as rollout to 290 sites is unlikely to be above what it would undertake regardless of any obligation.
- A non-mobile entrant would also likely prefer Option 2 but in the lower end of the range and closer to the 3.6 GHz Award obligations (**80 sites**) which resulted in new entry in that award.

A 11.25 Given a likely preference at the lower end of Option 2, a non-mobile new entrant is unlikely to prefer Options 3, 4 and 5 all of which have a higher rollout obligation than Option 2. Therefore, the views of non-mobile new entrants are not considered further in the assessment of those options below.

A 11.26 Therefore, ComReg is of the preliminary view that non-mobile new entrants would likely prefer **Option 2 (80 sites)** over all other options for all of the

prefer Option 2 if the level of rollout was set at the lower end of the 80 – 500 site range. In particular, Vodafone notes a nationwide rollout rate of 131 as an alternative.

⁶²² 195 sites live by December 2019

⁶²³ <https://www.rte.ie/news/business/2019/0213/1029304-imagine-to-bring-high-speed-broadband-to-rural/>

Performance Bands.

Option 3 (525 base stations)

MNOs

I. 2.1 GHz rollout

A 11.27 In relation to the 2.1 GHz Band, a proposed rollout to 550 base stations under Option 3 would be significantly less than MNOs existing deployment in the band. Further, it would provide MNOs with the flexibility to scale back the footprint of existing 2.1 GHz networks if the deployment of newly assigned bands was preferred from a network planning perspective as described in Option 2 above.

A 11.28 Therefore, in relation to the 2.1 GHz Band, MNOs are likely to be indifferent between Option 2 and Option 3 because such obligations would likely be less onerous than the current rollout in the 2.1 GHz band.

II. 2.3 GHz and 2.6 GHz rollout

A 11.29 In relation to the 2.3 GHz Band and 2.6 GHz Band, a proposed rollout to 550 sites would be below Vodafone's and Three's existing deployment in the 1800 MHz Band. However, Option 3 would be above the existing 1800 MHz rollout for Eir and it may therefore prefer Option 2 where a lower rollout obligation would apply. However, Eir has announced⁶²⁴ an expansion of 4G voice and data coverage, including "*hundreds of additional mobile base stations and upgrades to existing sites*". In order to maintain sufficient capacity across its expanded network Eir seems likely to increase rollout of 1800 MHz and, in doing so, a rollout of at least 550 base stations for the 2.3 GHz and 2.6 GHz Bands would appear feasible for Eir.⁶²⁵ In that regard, and in response to Document 19/59R, Eir did not raise any objections to rollout set at these levels.

MNO conclusion on all bands (Option 3)

A 11.30 ComReg is of the preliminary view that MNOs are likely to look favourably at Option 3 for all of the Performance Bands. For example, in response to Document 19/59R, Three and Eir did not raise objections to the rollout set at these levels. Alternatively, Vodafone appears to be of the view that a rollout obligation set at these levels could be excessive for it. Notwithstanding Vodafone's contention, ComReg is of the view that

⁶²⁴ <https://www.rte.ie/news/business/2018/1112/1010284-eir-network-investment/>

⁶²⁵ [REDACTED]

Vodafone's assessment of likely rollout is implausible for the reasons outlined in Chapter 7 and captured at the conclusion of this section under 'Impact on Stakeholders' below.

Other Service Providers

- A 11.31 Other Service Providers are unlikely to prefer Option 3 because this option is informed by the rollout of the 1800 MHz band which is used to deliver mobile services, and such a rollout would not be suitable for a FWA network. It is likely that Option 3 would require existing FWA operators to rollout additional base stations in areas where they may not necessarily have appropriate demand. This could also potentially result in such operators having to make inefficient investments in their network. Similarly, Other Service Providers would be unlikely to prefer Options 4 or 5 where higher obligations would apply. Therefore, the views of Other Service Providers are not considered further in the assessment of those options below.
- A 11.32 In light of the above, ComReg is of the preliminary view that Other Service Providers would likely prefer Option 2 over all other options for all of the Performance Bands.

Mobile entrants

- A 11.33 Mobile entrants are unlikely to prefer Option 3 over Option 2. A new entrant could also have a 700 MHz obligation⁶²⁶ to provide a 30 Mbit/s service to 90% of population and would likely use the Performance Bands to achieve that obligation where required. However, a new entrant would likely have a lightly loaded network until it gained a sufficient market share and therefore may have little justification in rolling out Performance Bands beyond the more densely populated areas of the country over the rollout period.
- A 11.34 Similarly, a high rollout obligation could act as a significant barrier to entry for a new entrant as such an obligation is unlikely to correspond to the market share and business needs of a new entrant, at least in the short to medium term. Accordingly, the higher rollout obligation could negatively impact on the willingness of mobile new entrants to participate in an award and ultimately provide services
- A 11.35 Therefore, mobile new entrants are unlikely to prefer Option 3 over Option 2. Similarly, mobile entrants would be unlikely to prefer Options 4 or 5 where higher obligations would apply. Consequently, the views of mobile entrants are not considered further in the assessment of those options below.

⁶²⁶ ComReg notes that any new entrant would likely need 700 MHz rights of use rather than rights of use to the Performance Bands in isolation.

A 11.36 In light of the above, ComReg is of the preliminary view that mobile entrants would likely prefer Option 2 (290 sites or smaller) over all other options for all the Performance Bands.

Option 4 (1,200 base stations)

MNOs

I. 2.1 GHz rollout

A 11.37 In relation to the 2.1 GHz Band, a proposed rollout to 1,200 base stations under Option 4 would be close to but still below MNOs existing deployment in the band. Further, it would still provide MNOs some flexibility to scale back the footprint of its existing 2.1 GHz network if the deployment of newly assigned bands was preferred from a network planning perspective. The extent to which MNOs would prefer Option 4 would likely depend on how much MNOs preferred to scale back existing 2.1 GHz deployment, if at all. In that regard, ComReg notes that for each operator the number of existing sites is 200 – 750 above the proposed obligation and is therefore likely to be achievable for all operators even accounting for any moderate scaling back of the 2.1 GHz Band.

A 11.38 Therefore, in relation to the 2.1 GHz Band, MNOs would likely be indifferent between Option 3 and Option 4 because such obligations would likely be below the current commercial rollout of the 2.1 GHz Band. For example, in response to Document 19/59R, Three and Eir did not raise objections to 2.1 GHz rollout under Option 4 (1,200 sites). Alternatively, as noted above, Vodafone appears to be of the view that a rollout obligation set at these levels could be excessive for it. Notwithstanding Vodafone's contention, ComReg is of the view that Vodafone's assessment of likely rollout seems implausible for the reasons stated in Chapter 7 and captured at the conclusion of this section 'Impact on Stakeholders'.

II. 2.3 GHz and 2.6 GHz rollout

A 11.39 In relation to the 2.3 GHz Band and 2.6 GHz Band, a proposed rollout to 1,200 sites would be above each MNOs existing rollout in the 1800 MHz Band and significantly so for Vodafone and Eir. Therefore, MNOs are unlikely to prefer Option 4 over Option 3 and Option 2 for these bands. Similarly, MNOs are unlikely to prefer Option 5 where higher obligations would apply. Therefore, the views of MNOs in relation to the 2.3 GHz Band and 2.6 GHz Band are not considered further in the assessment of that option below.

MNO conclusion on all bands (Option 4)

A 11.40 ComReg is of the preliminary view that MNOs are likely to look favourably at Option 3 for the Greenfield bands (i.e. 2.3 GHz and 2.6 GHz Bands) and Option 4 for the Brownfield Bands (i.e. 2.1 GHz Band). For example, in response to Document 19/59R, Three and Eir did not raise objections to the rollout set at these levels. Alternatively, as noted above, Vodafone appears to be of the view that a rollout obligation set at these levels (i.e. Brownfield (2.1 GHz) and Greenfield (2.3 GHz and 2.6 GHz) could be excessive for it. Notwithstanding Vodafone's contention, ComReg is of the view that Vodafone's assessment of likely rollout in these bands seems implausible for reasons stated in Chapter 7 and at the conclusion of this section 'Impact on Stakeholders'.

Option 5

I. 2.1 GHz rollout

- A 11.41 In relation to the 2.1 GHz Band, a proposed rollout to 1,900 + base stations would be significantly in excess of Vodafone's and Eir's existing rollout in the band but in line with that of Three's. However, Three's large deployment in the 2.1 GHz Band likely arises from its entry as a 3G only network using the 2.1 GHz MHz Band and its subsequent merger with Telefonica. A rollout of 2.1 GHz at these levels would provide Three little flexibility to rollout using other bands (e.g. sub 1 GHz Bands) where it previously used the 2.1 GHz Band or rationalise its 2.1 GHz site count. Three would likely prefer to have more control over when and how it rolls out its network across multiple bands.
- A 11.42 Option 5 would be aligned with the likely rollout of sub 1 GHz bands and MNOs would be required to rollout and maintain a more extensive network than the other options when it could be more efficient for each to spread their investment across other spectrum bands. This might particularly be the case in non-urban regions where sub 1 GHz bands are more conducive to providing wide area coverage.
- A 11.43 Therefore, in relation to the 2.1 GHz Band, MNOs would be unlikely to prefer Option 5 over Options 2, 3 and 4.

Stakeholder summary

A 11.44 In light of the above stakeholder assessment, ComReg summarises the likely views of the various stakeholders as follows.

- In relation to all the Performance Bands:

- Non-mobile new entrants would likely prefer Option 2 (80 sites) over all other options for all the Performance Bands.
- Mobile entrants would likely prefer Option 2 (290 sites or smaller) over all other options for all the Performance Bands.
- Other Service Providers would likely prefer Option 2 over all other options for all of the Performance Bands.
- In relation to the 2.1 GHz Band, MNOs would likely be indifferent to Option 4 because such obligations would likely be below the current commercial rollout of the 2.1 GHz Band.
- In relation to the 2.3 GHz Band and 2.6 GHz Band, MNOs would likely be indifferent to Option 3 because such obligations would likely be below the commercial rollout of both bands.

Commercial rollout

A 11.45 ComReg notes that the responses to Document 19/59R largely support the view that MNOs could competitively achieve the rollout obligations for the Performance Bands⁶²⁷ as outlined above. For example:

- Eir has expressed no objection to the targets proposed⁶²⁸ for the Performance Bands.
- Three considers the rollout obligations for the Performance Bands achievable but notes that such obligations are at the upper-end of what network operators could be expected to meet under competitive commercial conditions. It maintains that any further obligations would likely act as a deterrent to bidders in the auction.
- Vodafone states that these proposed obligations to be excessive and above the precautionary level.

A 11.46 ComReg notes Three's and Eir's acknowledgement that the rollout obligations for the Performance Bands are achievable. In particular, ComReg agrees that such obligations are likely at the upper end of what could be achievable and obligations above the levels specified in each of the Options above (while possibly achievable by some) would risk distortion to the award process.

A 11.47 Further, ComReg notes Vodafone's contention that the rollout obligation is excessive in its view and considerably above a precautionary level.

⁶²⁷ ComReg, Document 19/59R.

⁶²⁸ However, Eir requests ComReg to clarify what targets would apply if an operator is using the spectrum for mixed use. e.g. Mobile in some parts of the country and Other elsewhere.

However, ComReg considers that such an assessment is implausible for a number of reasons including:

- Vodafone's number of 2.1 GHz sites reduced by just 1 since the publication of ComReg Document 19/59R and overall site numbers at 1,504 are over 300 above the proposed obligation. As noted above, this provides sufficient flexibility for Vodafone to further rationalise as may be required.
- Rival operators who both have less market share and in some cases (particularly Eir)⁶²⁹ a less developed network all acknowledge that the proposed rollout rate is achievable. It seems implausible that the operator with the most subscribers would rollout the Performance Bands (which are used to provide capacity) at lower rates than its rivals.
- Even if Vodafone intended to rollout at lower levels, rival operators with less market share are targeting rollout rates significantly in excess of these levels which would likely incentivise Vodafone to increase its rollout rate in order to avoid losing market share.⁶³⁰

A 11.48 In that regard, ComReg is of the view that the likely preferences of each stakeholder group is accurately reflected in the stakeholder assessment above, and the relevant options are not in excess of what operators would likely deliver commercially in a competitive market.

Impact on Competition (step 4)

A 11.49 A coverage/rollout obligation should promote competition such that operators deliver and maintain an acceptable level of coverage/rollout across the country. In that regard, ComReg notes that MNOs would also be subject to the coverage obligation attached to the 700 MHz Duplex (should such rights of use be assigned to all MNOs). The 700 MHz obligation would already provide connectivity over a widespread area and MNOs would appear to have clear competitive incentives to add capacity to the coverage layer (using the Performance Bands) in order to attract new subscribers and increase the benefits for all subscribers using the network.

A 11.50 Further, in order to provide the proposed 30 Mbit/s obligation, MNOs would

⁶²⁹ Eir has less sites and spectrum rights of use than both Three and Vodafone.

⁶³⁰ For example, Didier Clavero, Vodafone Ireland CTO, recently noted that Vodafone "continually work(s) hard to maintain our position as the leading voice and data mobile provider in the country". <https://n.vodafone.ie/aboutus/press/vodafone-ireland-extends-5g-network-test-bed-as-it-prepares-for-.html>

also likely require the use of the Performance Bands in certain areas of the country. In that context, concerns around cherry picking and tacit collusion (as described in the 'Coverage' RIA) of mobile services are unlikely to be relevant with regard to the Performance Bands in this award.⁶³¹

A 11.51 However, given the variety of bands available in the Proposed Award there remains a number of concerns relevant to competition.

- The 700 MHz obligation only applies to mobile services and coverage/rollout obligations may be required for other potential uses of the Performance Bands (e.g. fixed wireless).
- Spectrum hoarding could deny the use of the Performance Bands to other users (MNOs or non-mobile users).
- The efficient use of the radio spectrum might not be best provided for if rollout only occurred at low levels but displaced more efficient uses/users.

Option 1

A 11.52 Option 1 could promote competition because it would not run the risk of precluding new entry through setting an obligation that could not reasonably be achieved by a new entrant. Winning bidders would also have a high degree of flexibility and could choose their own rollout levels allowing customers to make a choice of provider based on the services provided.

A 11.53 However, Option 1 may harm competition to the extent that it could increase the risks of spectrum hoarding as bidders would be under no obligation to rollout any services using the Performance Bands. For example, some respondents to Document 18/60 expressed concern that certain operators might hoard spectrum damaging the FWA sector and or displacing future uses. Similarly, Option 1 could result in strategic bidding, denying rights of use to more efficient users who would provide services to consumers. Setting rollout obligations would better provide for the efficient use of the Performance Bands by ensuring that the spectrum is used to deploy services more efficiently than may otherwise be the case.

A 11.54 Given that such entrants should rollout a network to some degree, regardless of any obligation, competition and the efficient use of the radio spectrum would be better promoted by having a rollout obligation that

⁶³¹ ComReg notes that cherry picking and tacit collusion are only likely to be relevant to mobile services. In relation to Fixed wireless services the most profitable urban areas are already covered using traditional fixed (fibre) services and tacit collusion is unlikely in rural areas as the cost of extending fixed wireless across a wider area is significantly lower compared to mobile services.

reflected the likely commercial deployment. Therefore, ComReg is of the preliminary view that an appropriate rollout obligation is necessary for the Performance Bands and, depending on the use case, Option 2, 3 or 4 would, on balance, have a more positive impact on competition than Option 1.

Option 5

A 11.55 Option 5 could lead to a more comprehensive rollout of services, however, Option 5 would be in excess of existing rollout in similar bands (mobile and non-mobile). By imposing a high rollout obligation, Option 5 is more likely than other options to discourage participation and dampen competition within the Proposed Award.

A 11.56 Further, setting a rollout obligation which is too high could result in the spectrum going unsold which could significantly harm infrastructure based competition given the large amount of spectrum available. It could also negatively impact on competition at the retail level by increasing the likelihood that any winning bidders would make inefficient investment in the network.

A 11.57 Therefore, ComReg is of the preliminary view that Option 5 would not be appropriate for any use type in the Proposed Award, it is likely that Options 2, 3 or 4 would have a more positive impact on competition than Option 5.

Options 2, Option 3 and Option 4

A 11.58 Provided any obligation was not out of line with operators 'investment plans' (both incumbents and new entrants), a coverage obligation is unlikely to have a negative impact on competition. In that regard, and noting the assessment of stakeholders likely deployment above, ComReg is of the preliminary view that, on balance:

- Option 2 would have a more positive impact on competition with respect to **Other Service Providers and new entrants (mobile and non-mobile)** compared to other options because:
 - Rollout would not be set at levels⁶³² above that which operators could achieve commercially. Options 3 and 4 would likely act as a significant barrier to entry as rollout set at these levels would likely be above what could be achieved commercially.

⁶³² 290 sites mobile and 80 non-mobile (e.g. fixed wireless)

- Options 3 and 4 could also negatively impact on competition at the retail level by increasing the likelihood that winning bidders would make inefficient investment in infrastructure.
- Option 3 would have a more positive impact on competition with respect to the **mobile rollout of the 2.3 GHz Band and 2.6 GHz Band** compared to other options because:
 - It would better encourage efficient use of the radio frequencies compared to Option 2.
 - Options 4 and 5 would likely act as a significant barrier to entry as rollout set at these levels would be significantly above what could achieve commercially in other related bands (e.g. 1800 MHz).
 - Further, these options would likely limit competition during the award and could also negatively impact on competition at the retail level by increasing the likelihood that winning bidders must make inefficient investment in the network.
- Option 4 would have a more positive impact on competition with respect to the 2.1 GHz Band compared to other options because it would better encourage the efficient use of the radio frequencies compared to Options 2 and 3 and rollout would not be excessively scaled back below levels necessary to achieve an efficient rollout.

Impact on Consumers

A 11.59 It can be assumed that what is good for competition, and what promotes investment in infrastructure, is, in general, good for consumers. This is because increased competition between operators brings benefits to their customers in terms of price, choice and quality of services. In that regard, options that are good for competition above are likely to be good for consumers. For example, consumers are likely to prefer those options which maintain or improve services and coverage while at the same time not deterring entry or efficient investment.

Option 1

A 11.60 From the perspective of all consumers, whilst Option 1 is likely to make entry more attractive compared to other options, it leaves the risk that spectrum would not be used or used inefficiently denying spectrum rights to more efficient users who could provide services that consumers need. Therefore, consumers are unlikely to prefer Option 1.

Option 5

A 11.61 Consumers may, on first impressions, prefer Option 5 as this provides for a high rollout obligation for all services. However, Option 5 could reduce consumer welfare in a number of ways, including:

- restricting the extent to which providers including new entrants would be willing to participate in the Proposed Award and therefore provide services at all.
- diverting investment away from providing sites in areas where capacity constraints exist now or in the future.
- increasing the price of mobile services, if the cost of inefficient investment is passed on. As previously noted, consumers have a low willingness to pay for additional coverage meaning the use of other parts of the competitive offering (data, voice text) may have to be reduced.

A 11.62 In light of the above, consumers are unlikely to be in favour of Option 5 as it would not have the greatest positive impact on users.

Option 2, Option 3 and Option 4.

A 11.63 Given the different uses likely to arise from the Performance Bands, consumers are likely to prefer different options depending on the services provided by winning bidders and whether new entry is promoted. In that regard, consumers are likely to prefer options that strike the right balance between encouraging rollout to the greatest extent (ensuring that spectrum is used efficiently) and promoting competition.

A 11.64 For **fixed wireless** services, consumers would likely prefer Option 2 over other options for a number of reasons.

- It would provide for fixed wireless services to be rolled across a meaningful area.
- It would best encourage potential new FWA entry which could provide more choice for consumers.
- It is unlikely to place an onerous obligation on FWA service providers requiring inefficient investment or leading to higher prices.

A 11.65 Consumers would also prefer Option 2 as an obligation for new mobile entrants as this would encourage new entry and ensure any new entrants would be required to provide services to a minimum level.

A 11.66 For existing **mobile services**, consumers would likely prefer that the 2.3 GHz Band and 2.6 GHz Band were subject to Option 3.

- It would increase the potential for these bands to be assigned to users who would provide services that consumer's value over a long period.
- It would not discourage MNOs from potentially acquiring additional spectrum which enables considerably higher user data rates and supports a greater number of users, all of which will substantially enhance the consumer experience
- The greater connectivity benefits would be achieved across a wider area benefiting more consumers than Option 2.

A 11.67 For existing **mobile services**, consumers would likely prefer that the 2.1 GHz Band is subject to Option 4 because it is best aligned with the existing deployment of the 2.1 GHz Band (compared to other options) and ensures that any scaling back is limited to the efficient rollout of services across its network.

The Draft Rollout RIA: Assessment and Preferred Option (step 5)

A 11.68 In light of the above, ComReg is of the preliminary view that a combination of the options is required rather than applying one option uniformly to all new rights of use.

A 11.69 As outlined in Chapter 7, for the avoidance of doubt, if an operator obtains rights of use in the 2.6 GHz Duplex and the 2.6 GHz Duplex Gap, the base stations obligation must be met in each.

A 11.70 Table 23 below summarises ComReg's preliminary view on the preferred options.

Table 23: Summary of Preferred Options following the Draft Rollout RIA

Service	New Entrant Obligation				Existing Operator Obligation			
	2.1 GHz	2.3 GHz	2.6 GHz FDD	2.6 GHz TDD	2.1 GHz	2.3 GHz	2.6 GHz FDD	2.6 GHz TDD
Time	5 Years				4 Years			
Mobile	Option 2 (290)	Option 2 (290)	Option 2 (290)	Option 3 (290)	Option 4 (1,200)	Option 3 (550)	Option 3 (550)	Option 3 (550)
Other	Option 2 (80)	Option 2 (80)	Option 2 (80)	Option 2 (80)	Option 2 (290)	Option 2 (290)	Option 2 (290)	Option 2 (290)

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Annex: 12 Draft Voice Call Services and Network Availability RIAs

A12.1 Introduction

A 12.1 In Annex 6 of this document, ComReg sets out its preliminary view that the 700 MHz Duplex, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands should be included in the Proposed Award.

A 12.2 This Annex sets out ComReg's draft RIAs in respect of whether:

- a voice call service licence condition should be attached to spectrum rights issued in the above bands (draft 'Voice Call Services' RIA); and
- a network availability licence condition should be attached to spectrum rights issued in the above bands (draft 'Network Availability' RIA).

RIA Framework

A 12.3 The purpose, structure and scope of the RIA framework is discussed at the beginning of the draft 'Spectrum for Award' RIA which is set out in Annex 6 and is not repeated here.

A12.2 The draft 'Voice Call Services' RIA

A 12.4 The focus of this draft RIA is to identify the impact of the regulatory options under consideration on stakeholders (including existing operators, potential new entrants, and consumers) and on competition and, in so doing, to identify the option that would best achieve ComReg's objectives. ComReg notes that the proposed voice call QoS obligation would only apply to operators providing voice call services.

A 12.5 As set out in Chapter 7 of this document, the voice call QoS licence condition proposed would only apply to 'managed' voice call services, and this draft RIA therefore only considers 'managed' voice call services. 'Managed' voice call services includes the traditional voice call services carried over circuit-switched connections and the 'managed' packet-switched voice call services (e.g. using VOIP⁶³³ or some other similar

⁶³³ Voice over Internet Protocol.

protocol) which can be provided over different technologies (e.g. VoLTE⁶³⁴, Native Wi-Fi, etc.).

A 12.6 It is not proposed that a voice call QoS licence condition would apply to 'Unmanaged' voice call services⁶³⁵. Such services including voice call services provided by over the top (OTT) applications that do not use session initiation protocol/IP multimedia subsystem (SIP/IMS) signalling and are delivered in a best effort manner through the Internet access service (i.e. with no prioritisation).⁶³⁶

Policy issues

A 12.7 Voice calls remain an important service for consumers, with 93% using their mobile phone to make traditional voice calls using telephone numbers⁶³⁷. Further, use of traditional mobile voice minutes has increased by around 15%)⁶³⁸ since the 2012 MBSA despite the increased availability of OTT applications such as Skype and WhatsApp.

A 12.8 As illustrated in the 2019 Mobile Consumer Experience Survey⁶³⁹, the main outdoor service issues across all types of consumers (rural and urban) relate to voice calls. For example, of respondents who experienced services issues:

- 44% noted that the quality of reception deteriorated when on a call.⁶⁴⁰
- 47% could not make a call.⁶⁴¹
- 36% could not receive a call.⁶⁴²
- 35% experienced a dropped call⁶⁴³

⁶³⁴ VoLTE is a managed voice service that benefits from prioritisation over other traffic.

ITU, 'Quality of Service Regulation Manual' (2017), Section 5.4.4.

https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-BB.QOS_REG01-2017-PDF-E.pdf

⁶³⁵ 'Unmanaged' voice call services are provided over the applications and/or networks of third parties over which the licensee would have very limited control in terms of the quality of the service experienced by the end user.

⁶³⁶ ITU, 'Quality of Service Regulation Manual' (2017), Section 5.4.4.

⁶³⁷ Mobile Consumer Experience Survey 2019, document 19/101, Slide 50.

⁶³⁸ ComReg Quarterly Report 2019, Document 19/112.

⁶³⁹ Mobile Consumer Experience Survey 2019, Document 19/101.

⁶⁴⁰ Ibid, Slides 87, 88, 89 & 90.

⁶⁴¹ Ibid

⁶⁴² Ibid.

⁶⁴³ Ibid

A 12.9 The outdoor population coverage obligations proposed in Chapter 7 may provide for voice coverage. However, because voice services are currently provided over GSM and UMTS (i.e. 2G and 3G networks) it is not clear whether a population coverage obligation at a rate of 30 Mbit/s would necessarily improve the quality of service for voice calls to any material degree.

A 12.10 The policy issue to be addressed is therefore whether it is appropriate to impose specific QoS obligations in respect of voice call services to ensure that users are offered a minimum service level by operators who secure rights of use in the Proposed Award.

Objectives

A 12.11 The focus of this RIA is to assess the impact of the proposed measure(s) (i.e. various regulatory options) on stakeholders, competition and consumers. In that way, it allows ComReg to identify and implement the most appropriate and effective obligations, while still allowing ComReg to achieve its objectives. In considering the above policy issue, ComReg is guided by what it considers to be the most relevant statutory objectives, including:

- assigning rights of use in line with the various EC Decisions⁶⁴⁴ relating to the Proposed Bands and other relevant legislation;
- to ensure that all end users, including disabled users, derive maximum benefit in terms of choice, price and quality;
- to encourage the efficient use and ensure the effective management of spectrum; and
- to ensure there is no distortion or restriction of competition in the electronic communications sector.

A 12.12 Of further relevance to the issue of voice obligations for 700 MHz rights of use is:

⁶⁴⁴ For example:

- EC Decision 2008/477/EC of 13 June 2008 (“2.6 GHz EC Decision”);
- (EU) 2016/687 of 28 April 2016 (“700 MHz EC Decision”).
- Decision 2012/688/EU of 5 November 2012 (“2.1 GHz Decision”).

- EP&C Decision 2017 (EU)2017/899 which, among other things, obliges Member States to:
 - assess the need to attach conditions to the rights of use for frequencies within the 700 MHz frequency band and, where appropriate, shall consult relevant stakeholders in that regard.
- MPBT - [Focus Group Report on Mobile Coverage](#)⁶⁴⁵ and in particular the 2017 Action Point 39 which notes that “*All operators will introduce WiFi calling, VoLTE and other network feature and functionality enhancements at the earliest juncture and report on progress to the Taskforce Implementation Group.*” While this is a 2017 Action Point it remains important particularly since these network features and functionality enhancements remain unavailable for certain consumers.

A 12.13 ComReg’s overall powers, functions, duties and objectives in relation to the management of the radio frequency spectrum in Ireland are set out in Annex 2. The most relevant objectives in terms of QoS (Voice Call Services) is to ensure that all users derive maximum benefit in terms of price, choice and quality from the spectrum to be made available in the Proposed Award.

Identifying the regulatory options

A 12.14 In light of the above, ComReg has identified the following options:

- **Option 1:** Do not attach a voice QoS licence condition to rights of use granted in the Proposed Award used to provide ‘managed’ voice call services. .
- **Option 2:** Attach a voice QoS licence condition (in respect of ‘managed’ voice call services) to all rights of use granted in the Proposed Award:
 - *Option 2A:* Impose such QoS conditions in line with licence condition in the 3.6 GHz Band Liberalised Use Licences⁶⁴⁶.
 - *Option 2B:* Impose such QoS conditions in line with the licence condition in the 3.6 GHz Band Liberalised Use Licences⁶⁴⁷ and additionally include an obligation that where LTE is deployed in the Proposed Bands, and where consumers using the Proposed Bands are also offered a mobile voice service, VoLTE technology

⁶⁴⁵ MPBT - [Focus Group Report on Mobile Coverage](#)

⁶⁴⁶ See [S.I. No. 532/2016](#) - Wireless Telegraphy (3.6 GHz Band Licences) Regulations 2016.

⁶⁴⁷ See [S.I. No. 532/2016](#) - Wireless Telegraphy (3.6 GHz Band Licences) Regulations 2016.

must be enabled on the licensee's network and the base stations in the Proposed Bands and made available to consumers (including MVNO consumers) that have a VoLTE enabled handset within an appropriate period.

Impact on stakeholders

A 12.15 There are a number of key industry stakeholders in relation to the matters considered in this chapter:

- Mobile Network Operators (MNOs)⁶⁴⁸
- MVNOs
- Potential new entrants

A 12.16 These are assessed separately under each of the options below.

Option 1 v Option 2

MNOs

A 12.17 A number of factors can affect consumers' QoS in voice services including network congestion in a particular area or the performance of a particular handset. While some of these factors may be outside the control of the mobile operators (e.g. handset performance)⁶⁴⁹, the technical performance of each operator's network does represent a key differentiator in the QoS delivered by different networks.

A 12.18 While an operator can guarantee a certain minimum QoS for voice calls made between subscribers on its own network, it cannot guarantee a certain minimum QoS for voice calls when its subscribers make/receive calls to/from a different network, as such voice calls originate/terminate on a different network (either fixed or mobile). In Q3 2019, 46% of all mobile-to-mobile calls were made to networks other than the dialling party (i.e. off-network).⁶⁵⁰ In effect nearly half of all mobile to mobile calls made would have required both MNOs to have a sufficient QoS voice call standard in order to provide good quality services between callers on different

⁶⁴⁸ FWA operators are not considered in this RIA as such operators do not provide mobile voice calls and would therefore not be subject to VoLTE obligations.

⁶⁴⁹ Document 18/105 'Mobile Handset Performance (Voice)' was published in February 2018 and identified a variation in performance of up to 14 dB between handsets, meaning that some handsets have significantly poorer reception than others. In effect, consumers living in areas where signal strength is more marginal could potentially significantly improve their connectivity experience by changing their handset

⁶⁵⁰ ComReg Quarterly Key Data Report Q3 2019. Document 19/112.

networks.

- A 12.19 However, in the event that consumers experience a poor quality voice call service, it is often unclear which network is primarily responsible for the deterioration in voice call quality. Unless consumers are able to take the QoS offered by different operators into account when making purchasing decisions, there is less incentive for operators to invest in improving it.
- A 12.20 Under Option 1, the non-imposition of a minimum standard for a voice call could create an incentive for a licensee (or other third party providers) to engage in behaviour which resulted in the quality of its voice calls falling below the current standards (e.g. through lack of investment or poor network planning). In addition, other operators with higher quality standards would not be able to isolate the higher quality standards applied to voice calls on their own network from the lower quality standards applied on other networks. This, in turn, arguably reduces the incentive for those operators to maintain those higher standards.
- A 12.21 Under Option 1, MNOs might not reap the benefit of investments in its network to the extent that those investments should improve the voice experience for its consumers. Such higher quality operators might then have less incentive to maintain this higher QoS and may allow the quality of their voice calls to fall. Such an overall reduction in quality for voice calls could result in lower consumer demand for voice calls or switching to OTT providers, which in turn would negatively impact all providers of voice call services, though no individual provider would have an incentive to unilaterally increase quality back to previous levels.
- A 12.22 Under Option 2, the imposition of minimum QoS conditions for voice calls would prevent such a situation from arising, and ensure that all operators would be subject to the same minimum standard and, as such, each would be assured that no other operator could avoid meeting these minimum standards. Under Option 2, the obligation to provide a minimum QoS standard on voice call services would apply equally to all MNOs. It would provide some assurance that any investment in voice services would be based on minimum standards being implemented by other MNOs. This would reduce the extent to which the negative consequences referred to above under Option 1 could arise.
- A 12.23 ComReg acknowledges that Option 2 may involve some compliance costs for MNOs which would not arise under Option 1. However, incumbent MNOs are already subject to minimum voice call QoS obligations under current Liberalised Use Licences (800 MHz, 900 MHz, 1800 MHz and 3.6 GHz Frequency bands) so the extension of the voice call QoS obligations to the bands covered by the Proposed Award is unlikely to impose a

significant additional cost to incumbent MNOs, particularly in relation to Option 2A.

A 12.24 In light of the above, it is difficult to say whether existing MNOs would prefer Option 1 over Option 2. This may very well depend on the MNO in question.

New entrants

A 12.25 It is not clear whether new entrants would favour a voice call QoS obligation. However, ComReg observes that in the 3.6 GHz Award, six of the seven respondents (including new entrants) to Document 15/70 agreed that a QoS obligation was necessary⁶⁵¹. Therefore new entrants may be of the view that Option 2 provides good incentives for all operators to maintain a good voice call standard. New entrants may also be of the view that such conditions improve the perception of the network and such benefits are likely to exceed any compliance costs.

A 12.26 Therefore, ComReg is of the preliminary view that new entrants would be unlikely to prefer Option 1 over Option 2.

MVNOs

A 12.27 An MVNO would likely prefer the option that maximises the QoS that would be available to its consumers. Under Option 1, MVNOs would be exposed to the risk that consumers may consider its service to be inferior because either its host or receiving network has low QoS standards. Further, MVNOs would be unlikely to choose a host operator that did not have certain minimum QoS, in the first instance, reducing competition in the wholesale market for access.

A 12.28 Therefore, ComReg is of the preliminary view that MVNOs would prefer Option 2 over Option 1.

Option 2A v Option 2B

A 12.29 Option 2B is the same as Option 2A except for the inclusion of an obligation where if LTE is deployed in the Proposed Bands, and where consumers using the Proposed Bands are also offered a mobile voice service, VoLTE technology must be enabled on the licensee's network and the base stations in the Proposed Bands and made available to consumers (including MVNO consumers) that have a VoLTE enabled handset to provide for additional QoS. Therefore, the extent to which stakeholders would prefer

⁶⁵¹ The only respondent who disagreed at that time was Three, who was not in favour of that type of obligation which it considered to be more appropriate to a "core" mobile band.

Source: Document 15/140 – Para A9.90 and A9.91.

Option 2A or 2B may to some extent depend on whether it would additionally prefer the rollout of VoLTE on its network within an appropriate period. The time period for VoLTE rollout is discussed in Chapter 7.

MNOs

A 12.30 Under Option 2A, each new licensee would have full flexibility to choose whether or not to provide VoLTE to its consumers. A licensee could choose not to rollout VoLTE on its network, or choose a rollout in line with demand for services. However, MNOs are likely to favour the rollout of VoLTE as it is likely to provide a number of benefits to MNOs. For example:

- The deployment of VoLTE would release additional spectrum for LTE services after the transition from 2G/3G services which are currently necessary in the provision of voice services.
- VoLTE provides greater spectral efficiency and capacity gains compared with conventional circuit-switched calls over legacy 2G and 3G networks. VoLTE has up to three times more voice and data capacity than 3G UMTS and up to six times more than 2G GSM.⁶⁵²
- VoLTE can provide operational savings for operators as it can run all services (voice and data) across the same infrastructure compared to having one for data and one for voice.^{653 654}
- VoLTE should slow down revenue erosion towards OTT providers by leveraging the seamless use experience between all access networks without disruption even in the case of network congestion.⁶⁵⁵
- 5G requires MNOs to have VoLTE implemented in the network to enable 5G voice, so it would seem important to deploy VoLTE before the widespread introduction of 5G smartphones, which will also

⁶⁵² Document 17/70r, 'Market Review Fixed Voice Call Termination and Mobile Voice Call Termination', published 2 November 2017, p75.

⁶⁵³ <https://www2.deloitte.com/ie/en/pages/technology-media-and-telecommunications/articles/tmt-pred16-telecomm-volte-vowifi-capacity-reach-capability.html>

⁶⁵⁴ Network standards like UMTS open a dedicated channel between nodes to handle voice, text and data, in a technique called "circuit switching. VoLTE works over IP-based networks and supports packet switching which allows users to equally share bandwidth resources rather than dedicated channels.

⁶⁵⁵ Krussel, P (2016), 'Future Telco: Successful Positioning of Network Operators in the Digital Age' Springer, p144.

require voice service capabilities.^{656 657} (i.e. 5G voice calls will not work via circuit-switched connections). All MNOs have announced plans to rollout 5G networks.⁶⁵⁸

- VoLTE offers improved voice call quality⁶⁵⁹ and would reduce consumer service issues relating to voice. Consumer switching related to voice call issues would therefore arguably be reduced. (See paragraph A 12.52 below).
- VoLTE compatible handsets are becoming more widespread. For example, VoLTE is compatible with all iPhones from the iPhone 6 (released in 2015) onwards.⁶⁶⁰ In 2012, Samsung announced VoLTE will become available starting with the Galaxy S III LTE device.⁶⁶¹ Samsung and Apple account for around 70% of all iPhones.

A 12.31 For these reasons, operators in Ireland and other jurisdictions have already begun to roll out VoLTE. For example

- A total of 262 operators are investing in VoLTE in 120 countries, including 194 operators with commercially launched VoLTE-HD voice service in 91 countries, up from 172 operators in 83 countries 12 months ago.⁶⁶²
- Vodafone recently announced the rollout of VoLTE across the entire country⁶⁶³ following trials in 2017⁶⁶⁴ and is the only operator providing VoLTE services in Ireland on the iPhone.⁶⁶⁵

⁶⁵⁶ <https://www.ericsson.com/en/digital-services/offerings/voice-services/voice-over-lte/why-deploy-volte-now>

⁶⁵⁷ <https://www.nokia.com/blog/nokias-100th-volte-contract-and-why-it-matters-you/>

⁶⁵⁸ <https://n.vodafone.ie/network/5g.html>

<https://www.eir.ie/support/latest-updates/we-are-upgrading-our-mobile-network-to-become-5g-ready/>

<https://www.irishtimes.com/business/retail-and-services/revenues-rise-at-three-as-it-targets-aggressive-5g-rollout-1.3974028>

⁶⁵⁹ Einashar, A & A. El-Saidny, M (2018), 'Practical Guide to LTE-A, VoLTE and IoT: Paving the way towards 5G: 1st Edition' Wiley.

⁶⁶⁰ <https://support.apple.com/en-ie/HT203078>

⁶⁶¹ <https://news.samsung.com/global/samsung-ready-to-launch-worlds-first-voice-over-lte-smartphone>

⁶⁶² HD-Voice - VoLTE - VoWifi - VoLTE & ViLTE: Global Market Update – August 2019, <https://gsacom.com/paper/volte-vilte-global-market-update/>

⁶⁶³ <https://www.siliconrepublic.com/comms/volte-vodafone-voice-over-4g-wi-fi-5g>

⁶⁶⁴ <https://www.independent.ie/business/technology/vodafone-switches-on-volte-service-on-its-network-35973395.html>

⁶⁶⁵ <https://support.apple.com/en-ie/HT204040>

- Eir and Three also announced that they intend to rollout VoLTE services.^{666, 667}
- Mobile operators, through TIF, have indicated that the commercial implementation of VoLTE was planned by all operators for 2018.⁶⁶⁸

A 12.32 MNOs are likely to be concerned that the time period allowed for rollout would need to be sufficient in order to provide for a successful rollout. In that regard, Document 19/59R noted that the transition will take time, as the nature of the technology is complex and there are a variety of network and operational support system challenges^{669,670} to successfully launch and operate. If VoLTE was deployed over too short a period the quality of voice calls could deteriorate particularly where voice calls have to fall back on 2G/3G networks when 4G networks are unavailable (e.g. rural areas where 4G coverage is lower).⁶⁷¹ However, all MNOs committed to rollout VoLTE by end 2018. Therefore, while Eir and Three have not rolled out VoLTE, the transition process is likely to be sufficiently developed such that the launch of VoLTE should not take longer than the 2 years after licence commencement proposed by ComReg in Chapter 7. For example, Eir has already rolled out Native Wi-Fi so they will have already deployed an IP Multimedia System⁶⁷² (IMS) and introducing VoLTE should be an obvious next step in order to maximise service provision from the IMS.

A 12.33 In light of the above, Vodafone would likely be indifferent as to whether Option 2A or 2B is chosen as it has already rolled out VoLTE across the

⁶⁶⁶ <https://www.siliconrepublic.com/comms/huawei-eir>

<https://www.siliconrepublic.com/comms/eir-mobile-network-investment-ireland-4g-5g>

⁶⁶⁷ <https://www.irishtimes.com/business/retail-and-services/revenue-slips-10-at-mobile-operator-three-1.3176901>

⁶⁶⁸ Mobile Phone & Broadband Taskforce Quarterly Progress Report Q1 2018.

⁶⁶⁹ For example:

- **Call handover** - Where a user has initiated a call in an LTE cell but moved out of LTE coverage mid-call, the call must be seamlessly handed over from LTE to the 2G/3G voice network.
- **End-to-end quality of service** – Voice being real time in nature, any degradation in network performance can have a noticeable impact on call quality. The network has to be optimally tuned to ensure voice packets get the highest priority for duration of call.
- **QoS** - as customers move to the edge of the cell, low reliability of the connection and interference from neighbouring cells can result in dropped calls.

⁶⁷⁰ The recommended ITU-T G.1028 “End-to-end QoS for voice over 4G mobile networks” was developed by ITU’s standardization expert group for ‘performance, QoS and QoE’, ITU-T Study Group 12. ITU-T G.1028 offers guidance on the factors impacting the end-to-end performance of “managed” voice applications over LTE networks and how the impacts of these factors should be assessed.

⁶⁷¹ For example, transferring voice calls between LTE ‘packet switched’ to legacy 2G/3G ‘circuit switched’ can compromise quality of service and dropped calls. The use of 2G/3G technologies will likely be required until LTE coverage matches that of 2G/3G.

⁶⁷² The IP Multimedia Subsystem (IMS) provides the technical means for operators to transfer core services (voice, video and messaging) to an all-IP LTE environment.

entire country.

A 12.34 Alternatively, while Eir submits in its response to Document 19/59R that a VoLTE obligation seems reasonable, it claims that it has not had the time to validate the network for VoLTE in order to measure performance against the proposed targets. Therefore, notwithstanding Eir's view that ComReg's proposal is reasonable, Eir would prefer Option 2A to manage its own rollout of VoLTE.

A 12.35 Similarly, Three observed that such services would be introduced when the customer experience over a mobile network will be as good as circuit-switched voice. Therefore, Three is in favour of Option 2A whereby licensees should decide whether or when it is most appropriate to introduce services like VoLTE.

A 12.36 Therefore, on balance, MNOs are likely to prefer Option 2A over 2B but all have publically stated their intention to rollout VoLTE in any event.

New entrants

A 12.37 Any potential new entrant is likely to prefer an option which gives it maximum flexibility in its choice of business model in line with its commercial strategy and therefore Option 2A could be preferred over Option 2B. However, given that such an entrant would be unlikely to rollout a 2G/3G network to provide voice services, it would likely rollout VoLTE in tandem with the rollout of its network more generally in order to provide voice services. In effect, a new entrant may be indifferent as to whether Option 2A or 2B is chosen since the rollout of VoLTE would coincide with the rollout of its coverage network which is subject to a separate rollout obligation. (i.e. VoLTE would always be active across all of its sites).

MVNOs

A 12.38 An MVNO would likely prefer the option that maximises the amount of services that can be provided to consumers. In that regard, it would be unlikely to prefer Option 2A over Option 2B as this could unduly lead to a delay in the provision of VoLTE to its customers. MVNOs would likely prefer Option 2B but only to the extent to that it would not compromise the provision of voice services more generally.

Impact on competition

Option 1 v Option 2

A 12.39 QoS is an important aspect of competition and represents a key non-price consideration that determines how consumers choose their mobile phone

provider and/or switch away from existing providers. While 21% of consumers cite price as a reason for selecting their preferred mobile operator, 20% of respondents cite quality of service issues such as coverage and network reliability.⁶⁷³ In effect, both quality and price are important aspects of competition in mobile markets and a decrease in QoS (where price is unchanged) could be as harmful to consumer welfare as an increase in price (where QoS is unchanged).

A 12.40 Competition in relation to prices is normally straightforward (i.e. prices fall as competition increases). Typically, competition also has a positive impact on QoS as operators begin to compete more vigorously in relation to quality attributes. Moreover, quality considerations can also drive innovation within the market, thereby improving dynamic efficiency. For example, in an effort to improve efficiencies as well as the QoS provided to consumers, operators are looking to other solutions and technologies such as VoLTE⁶⁷⁴ and Native Wi-Fi⁶⁷⁵ to improve their voice call service. Further the rollout of Native Wi-Fi and/or VoLTE by certain operators should encourage others to do the same, increasing competition further.

A 12.41 However, under certain circumstances, increased competition could cause a stagnation or a reduction in QoS, if price competition becomes too intense and the need to reduce prices for less efficient operators causes it to sacrifice investment or reduce costs to the detriment of quality. While such a scenario would appear unlikely to arise, given the preference consumers place on quality in relation to mobile services, it cannot be ruled out in the future, particularly for any new entrants who would be aiming to establish market share.

A 12.42 Furthermore, as noted previously, it is difficult for MNOs to differentiate their services and compete on the basis of voice call QoS because of the difficulty in identifying the source of poor voice call standards. For example:

- i. Individual MNOs may find it difficult to isolate the higher quality standards applied to voice calls on their own network from the lower quality standards applied on other networks; and
- ii. Consumers who experience poor voice call quality cannot determine whether the problem relates to their own network or to the network of the person on the other end of the line.

A 12.43 An MNO with a high level of QoS may not reap the rewards from efficient investments or be aware that voice calls are not being delivered in line with

⁶⁷³ Mobile Consumer Experience Survey 2019, Document 19/101, Slide 37.

⁶⁷⁴ <https://n.vodafone.ie/network.html>

⁶⁷⁵ <https://www.eir.ie/wificalling/>

its network expectations. This could result in consumers forming views on voice call QoS that may not be related to the underlying performance of the network but rather based on a misperceptions arising from the poor QoS from a different MNO. Switching activity resulting from such misconceptions would not necessarily enhance consumer welfare since poor voice call QoS can affect all operators to a similar extent, albeit unknown to individual consumers.

- A 12.44 This could be particularly damaging to competition because a consumer's decision to switch would be based on a substantial information asymmetry (namely that the consumer would not be aware that poor voice QoS relates to the other callers network). Further, there is no switching activity that would improve the situation for consumers since poor voice QoS would affect all operators to a similar extent, albeit unknown to individual consumers.
- A 12.45 Moreover, reputational impacts, in and of themselves, are an important aspect of competition. For example, 27% of consumers cite 'Good Reputation' as a reason for choosing their current mobile provider.⁶⁷⁶ However, competition requires that such reputations are based on actual performance or perceptions of same rather than consumers being uninformed about a particular aspect of their service provision and the substantial information asymmetry has the effect of undermining competition on the basis of voice call QoS.
- A 12.46 Finally, given that the mix of spectrum available in this award which may be attractive to a new entrant, any such new entrant under Option 1 would not be obliged to have any minimum voice call QoS standards. Such a new entrant may decide to compete strongly on price to the detriment of QoS in order to gain market share. This would create a situation where incumbent MNOs are obliged to provide a minimum voice call QoS under existing licences⁶⁷⁷ and compete with a new entrant that has no such obligation.
- A 12.47 Alternatively, the provision of a minimum voice call standard would ensure that any competition on price would not come at the cost of unacceptably low QoS levels. Under Option 2A and 2B, all MNOs (incumbents and new entrants) would be subject to a minimum QoS obligation. This would provide a number of benefits that would likely promote competition better than Option 1. For example:

⁶⁷⁶ Mobile Consumer Experience Survey 2019, Document 19/101, Slide 37.

⁶⁷⁷ As noted above, MNOs are already subject to minimum QoS standards under current Liberalised Use Licences.

- It would allow price competition to take place without voice call QoS falling below certain minimum standards.
- Consumers would make better selection and switching decisions by reducing the extent to which such decisions would be based on unreliable or incorrect information.
- New entrants would have the same voice call QoS obligation as incumbent MNOs using other bands and would have to compete on the same basis.
- It would promote efficient investment and innovation in new and enhanced infrastructures by facilitating MNOs to make investments in the knowledge other MNOs would be subject to a minimum obligation in relation to voice call QoS.

A 12.48 Therefore ComReg is of the preliminary view that, on balance, Option 2 (2A or 2B) would have a more positive impact on competition than Option 1.

Option 2A V Option 2B

A 12.49 ComReg assesses the impact of Option 2A and Option 2B on competition under the following headings.

- Distortions to competition
- Maximising benefits to consumers
- Efficient use of the radio spectrum

Distortions to competition

A 12.50 Option 2B would only apply to operators that rolled out an LTE network. In that regard, if one or more operators failed to rollout VoLTE having already rolled out an LTE network, it could represent a distortion or restriction of competition which would not promote the interests of users in terms of price, choice and quality of service. Such distortions could arise depending on how competition across bundles and the components of those bundles evolves.

A 12.51 For example, consumers are much more likely to choose/switch to an operator based on monthly access charges, the prices of calls and the volume of minutes and data in bundles. Under Option 2A, if competition for a specific aspect of a consumer's bundle (i.e. voice call QoS) is weak relative to the provision of other aspects of the bundle (e.g. data), QoS improvements such as VoLTE may be unreasonably delayed or not passed

through to the customer. While such a situation is unlikely to arise (all MNOs have committed to the rollout of VoLTE), Option 2B would provide greater protections against distortions of competition compared to Option 2A.

Consumer benefits

A 12.52 ComReg notes that the full benefits of VoLTE would not be provided unless both ends of the call are delivered through LTE. For example, to make a VoLTE call using an iPhone (which accounts for a third of all phones) both ends of the call need to have VoLTE enabled.⁶⁷⁸ Under Option 2A, operators could delay or avoid the rollout of VoLTE meaning that significant portions of calls would have a lower standard of voice calls regardless of whether other operators rolled out VoLTE or not.

A 12.53 While a VoLTE to 3G call (as may occur under Option 2A) improves call quality compared to a 3G to 3G call⁶⁷⁹ a VoLTE to VoLTE call (as would arise under Option 2B) maximises the voice quality for all callers.⁶⁸⁰ In particular:

- the call set up latency for VoLTE to 3G call set is higher than in VoLTE to VoLTE call (even in near cell conditions).⁶⁸¹ A higher call latency can lead to broken voice or echo on the call.
- a VoLTE to 3G call can experience higher delays (e.g. call setup) due to the circuit switched part of the call.⁶⁸²

A 12.54 These benefits from VoLTE arise because the call setup is conducted within the same radio access network and there is no need to fall back to UMTS at the call set up stage, reducing the possibility for dropped calls. Additionally, the signalling speed in LTE on the radio interface is faster than in 3G and fewer signalling messages are needed to establish the call.^{683, 684}

A 12.55 Option 2B would provide protection that VoLTE would be provided by all operators and encourage the timely rollout of VoLTE. This would promote competition and maximise the benefits for consumers in terms of price, choice and quality by ensuring that the benefits of introducing new services

⁶⁷⁸ <https://support.apple.com/en-ie/HT203078>

⁶⁷⁹ Einashar, A & A. El-Saidny, M (2018), 'Practical Guide to LTE-A, VoLTE and IoT: Paving the way towards 5G: 1st Edition' Wiley, p177.

⁶⁸⁰ Ibid

⁶⁸¹ Ibid

⁶⁸² ibid

⁶⁸³ Ibid, p175.

⁶⁸⁴ See also Recommendation ITU-T G.1028 provides guidelines concerning the key ... performance of managed voice applications over LTE network.

would not be limited through lack of innovation on the part of other operators or new entrants.

A 12.56 Further, Option 2B would reassure network operators that they will not face the risk of one or more operators compromising the ability of the market to deliver consumer benefits across the entire market. This would encourage efficient investment in enhanced infrastructure, promoting innovation and ensuring the efficient use and effective management of the radio frequency spectrum.

Efficient use of the radio spectrum

A 12.57 A key objective in designing and carrying out this award process is to encourage the efficient use and ensure the effective management of the radio spectrum in order to promote competition and maximise the benefits for consumers in terms of price, choice and quality. In particular, ComReg has a statutory objective of promoting competition by means of ensuring the efficient use of spectrum.

A 12.58 In that regard, VoLTE optimises the spectral efficiency of mobile voice using LTE and delivers voice calls more efficiently. VoLTE provides significant spectral efficiency improvements compared to 2G/3G networks by using 3 times less spectrum for the same quality voice call⁶⁸⁵. Accordingly, Option 2B and the introduction of VoLTE across all networks would promote competition by encouraging more efficient use of spectrum resulting in more spectrum resources for the provision of high growth services (i.e. data) as only a limited amount of spectrum is required for voice service provisioning.

A 12.59 This can provide important benefits by allowing spectrum refarming to occur earlier than might be otherwise the case, this may bring about significant benefit for consumers and potential cost savings for operators by facilitating transition to more spectral efficient technologies and ensuring scarce spectrum resources can be allocated for data, IoT and other services which are growing at a faster rate than voice.⁶⁸⁶ This has clear advantages in terms of promoting spectrum use and related services, and in turn intensifying competition in downstream markets.

A 12.60 In light of the above, ComReg is of the preliminary view that Option 2B would, on balance, better promote competition than Option 2A.

Impact on consumers

⁶⁸⁵ Ibid

⁶⁸⁶ For example, data usage volumes increased by 30.8% in the last year. ComReg Quarterly Report Q3 2019. Document 19/112.

A 12.61 The ability to make or receive voice calls remains a highly utilised service and a key priority for consumers. Voice remains the most popular service used by consumers when using their mobile phones with 93% of consumers using their mobile phone to make voice calls (higher than text 90% and data 78%).⁶⁸⁷ For example, in Q4 2018, mobile minutes reached peak levels at nearly 3.2 billion minutes for that quarter.⁶⁸⁸⁶⁸⁹ Further the main outdoor service issues across all types of consumers (rural and urban) relate to voice calls. For example, of respondents who experienced service issues outside the home 46% believed that the quality of reception deteriorated when on a call.⁶⁹⁰

Option 1 v Option 2

A 12.62 Consumers would likely prefer any option which ensures that they receive a minimum voice call QoS (Option 2A and 2B) over an option which relies solely on market forces or the goodwill of individual operators (Option 1), as long as the preferred option does not otherwise result in reduced benefits in terms of price, choice and quality.

A 12.63 Further, as voice calls can originate and terminate on different networks, under Option 1 a consumer who experiences poor voice call quality cannot determine whether the problem relates to his/her own network or to the network of the person on the other end of the line. Consequently consumers would not be in a position to make informed choices based on the quality of voice calls.

A 12.64 Under Options 2A and 2B, setting minimum QoS standards for voice calls will promote the interests of consumers.

- It provides a minimum QoS voice call obligation to all MNOs which should ensure that the standard of voice calls does not fall below a certain level.
- This allows consumers to make more informed decisions about choosing a service provider and/or switching to an alternative provider.

⁶⁸⁷ Mobile Consumer Experience Survey 2019, Document 19/101, Slide 50.

⁶⁸⁸ ComReg Quarterly Report Q4 2018.

⁶⁸⁹ Mobile minutes has fallen slightly since then but still remains significant at 3.085 billion in Q3 2019. Document 19/112.

⁶⁹⁰ Mobile Consumer Experience Survey 2019, document 19/101, Slide 89.

- The standards under current Liberalised Use Licences⁶⁹¹ would be applied to future technologies maintaining voice call standards at current levels, at a minimum.
- It would ensure that services provided by new entrants would be subject to a minimum voice call QoS standard.

A 12.65 Further, the voice call QoS obligation would apply to any technology used by operators to deliver the managed voice service (e.g. VoLTE, Native-Wi-Fi, etc.). This would encourage operators to appropriately validate and test new technologies prior to rollout.

A 12.66 Therefore, consumers are unlikely to prefer Option 1 over Option 2A or Option 2B.

Option 2A v Option 2B

A 12.67 Option 2B provides the same benefits as Option 2A with the additional protection that all operators would provide VoLTE within an appropriate time period. VoLTE also offers a number of benefits to consumers that may not arise for all consumers under Option 2A. These include:

- the best voice quality compared to OTT and circuit-switched voice calls. LTE with a speech rate of 12.65 kbps falls within the range of 'good quality' specified in ITU-T P.863. On the other hand 3G and OTT falls within the range of 'Acceptable Quality' while 2G falls into 'poor quality'.⁶⁹²
- quicker call set-up times (0.9 – 2.2 seconds) compared to 3G circuit-switched networks (4 – 6 seconds).⁶⁹³
- seamless use of different applications as VoLTE enables customers to make high quality voice calls while simultaneously using 4G data, (e.g. to access information (maps, banking, documents) while talking to someone over the phone).⁶⁹⁴
- compared to using OTT Voice apps, VoLTE calls use less battery resources. Many factors affect battery life, but VoLTE uses network

⁶⁹¹ The Liberalised Use Licences in the 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz Frequency bands.

⁶⁹² Einashar, A & A. El-Saidny, M (2018), 'Practical Guide to LTE-A, VoLTE and IoT: Paving the way towards 5G: 1st Edition' Wiley, p212 – 213.

⁶⁹³ Holma, H, Toskalka, A & Reunanen (2016) 'LTE Small Cell Optimization: 3GPP Evolution to Release 13' John Wiley and Sons, p 404.

⁶⁹⁴ <https://www.ericsson.com/en/digital-services/offerings/voice-services/voice-over-lte/why-deploy-volte-now>

resources more efficiently such that, all else being equal, a battery will last longer⁶⁹⁵

A 12.68 While operators are likely to aim to prevent any disruption to voice services in order to retain and attract consumers there are situations where setting more specified QoS standards may be necessary in order to protect consumers. For example, ComReg notes that consumer experience with regard to voice connectivity has deteriorated since 2017. In 2019, 35% of consumers have experienced voice issues compared to 31% in 2017⁶⁹⁶. In that regard, consumers would likely prefer Option 2B as it gives additional protections above Option 2A.

A 12.69 Further and as noted in the 'Impact of competition' above the benefits referred to in the preceding paragraph would not be fully realised unless all MNOs transition to VoLTE.

A 12.70 Therefore, ComReg is of the preliminary view that consumers are likely to have a preference for Option 2B over Option 2A.

Preferred Option

A 12.71 In light of the preceding discussion, ComReg is of the preliminary view that, on balance, Option 2B should be preferred over the other options, in terms of its overall impact on stakeholders, competition and consumers.

A12.3 The draft 'Network Availability' RIA

A 12.72 This section sets out the draft 'Network Availability' RIA. The focus of this draft RIA is to identify the impact of the regulatory options under consideration on stakeholders (including existing operators, potential new entrants, and consumers) and on competition and, in so doing, to identify the option that would best achieve ComReg's objectives.

Policy Issue and Objectives

A 12.73 The policy issue to be addressed in this draft RIA is whether a network availability condition should be imposed on holders of liberalised licences in the 700 MHz Duplex, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands, in order to ensure that any periods during which a licensee's network is unavailable do not exceed a specified level.

A 12.74 ComReg's overall powers, functions, duties and objectives in relation to the

⁶⁹⁵ <https://www.nokia.com/blog/why-operator-volte-beats-ott-voip/>

management of the radio frequency spectrum in Ireland are set out in Annex 2. The most relevant objectives in terms of QoS (Network Availability) is to ensure that all users derive maximum benefit in terms of price, choice and quality from the spectrum to be made available in the Proposed Award.

Identifying the regulatory options

A 12.75 ComReg has identified the following options:

- **Option 1:** Do not impose minimum QoS conditions in respect of the availability of the network
- **Option 2:** Set minimum QoS conditions in respect of the availability of the network, based on current liberalised use licence conditions, such that each licensee shall ensure that service unavailability shall be less than 35 minutes⁶⁹⁷ (based on weighting factors) per six month period.

Impact on stakeholders

A 12.76 Option 1 would allow operators full discretion over how often and how long their networks may be unavailable (e.g. for the purposes of systems upgrades etc.).

A 12.77 Option 2 may require network operators to incur additional expenditure in their networks to ensure compliance with obligations (e.g. back-up systems) over and above the level which they would choose to incur, absent the licence condition. However, operators may be of the view that such conditions improve the perception of the network and such benefits are likely to exceed any compliance costs. Furthermore, as noted above, respondents to the consultation on the 3.6 GHz Award⁶⁹⁸ were generally in favour of such obligations. Also, MVNOs are likely to prefer Option 2 over Option 1 (for the same reasons as set out in paragraph A 12.27 above).

A 12.78 Therefore, operators may, on balance, be indifferent as to whether Option 1 or 2 is chosen.

Impact on competition

A 12.79 Neither option is likely to impact materially on competition as any conditions imposed would apply equally to all licensees. Option 1 could, however, result in less competitive intensity in terms of network availability than would

⁶⁹⁷ This is based on the network availability licence condition in the Liberalised Licences for spectrum rights in the 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz bands.

⁶⁹⁸ See Document 15/140.

occur under Option 2, for the reasons described in the above draft 'Voice Call Services' RIA.

Impact on consumers

- A 12.80 Network availability is of fundamental importance to consumers. If any network is unavailable, subscribers on that network cannot use services. Consumers face serious disruption if the network to which they are subscribed is unavailable. The longer the period of unavailability, the greater the level of disruption. Setting a licence condition relating to network performance would safeguard the interests of consumers against operators who might otherwise have an unacceptably high level of network unavailability;
- A 12.81 Option 2 would ensure that consumers would be protected against an unreasonable level of disruption to services.
- A 12.82 Under Option 1, operators may, amongst other things, have an incentive to undertake lower levels of investment in their networks in terms of operability than would otherwise be the case, or to impose unreasonable levels of disruption on their customers when undertaking systems upgrades, etc.
- A 12.83 The QoS obligation imposed under Option 2 would apply to licensees which means, in turn, that licensees would need to ensure that third parties using their network assist it in achieving compliance as appropriate. As a result, all consumers regardless of the provider would benefit from the obligation.
- A 12.84 For these reasons, consumers would most likely prefer Option 2 whereby all Licensees are required to ensure that the overall duration of network unavailability does not exceed a specified level, assuming that this requirement does not otherwise result in reduced benefits in terms of price, choice and quality.

Preferred Option

- A 12.85 In light of the preceding discussion, ComReg is of the preliminary view that, on balance, Option 2 should be preferred over Option 1, in terms of its overall impact on stakeholders, competition and consumers.

Annex: 13 Draft Indoor mobile voice and text coverage RIA

A13.1 Introduction

- A 13.1 Consumers regularly use their mobile phones for voice, text and data services indoors (e.g. at home or work). However the increasing use of modern building materials,⁶⁹⁹ and, in particular certain types of insulation to improve energy performance, is resulting in a rise of the attenuation of signals in penetrating buildings reducing the coverage available indoors. For example all new buildings since 1 November 2019⁷⁰⁰ require a minimum A2 BER rating.⁷⁰¹
- A 13.2 While such coverage issues affect voice, text and data services, this Annex considers the regulatory options in relation to improving mobile voice call and text services indoors.⁷⁰² Voice calls and texts are an important mobile service and indoor voice and text coverage appears to be increasingly important to consumers as most voice calls and texts on mobile devices are made indoors⁷⁰³ and fixed line usage is declining.
- A 13.3 This Annex sets out the draft 'Indoor mobile voice and text coverage' RIA and informs ComReg's consideration of appropriate licence obligations to address indoor mobile voice and text coverage as set out in Chapter 7 of this paper.
- A 13.4 The focus of this draft RIA is to identify the impact of the regulatory options under consideration on stakeholders (including existing operators, potential new entrants, and consumers) and on competition and, in so doing, to identify the option that would best achieve ComReg's objectives. ComReg notes that the adoption of one of these options as an obligation would only apply to operators providing voice call and text services.

⁶⁹⁹ The Effect of Building Materials on Indoor Mobile Performance, published April 2018, Document 18/05.

⁷⁰⁰ European Union (Energy Performance of Buildings) Regulations 2019

⁷⁰¹ <https://www.housing.gov.ie/housing/building-standards/energy-performance-buildings/energy-performance-buildings>

⁷⁰² For indoor mobile data service coverage, ComReg observes that with rollout of the availability of fixed broadband services to all premises in Ireland under the NBP, consumers will be able to improve their indoor mobile data services through the use of Wi-Fi with a fixed broadband connection.

⁷⁰³ See paragraph A 1.6 below.

RIA Framework

A 13.5 The purpose, structure and scope of the RIA framework is discussed at the commencement of the draft 'Spectrum for Award' RIA which is set out in Annex 6 and is not repeated here.

Policy Issues

A 13.6 Indoor voice and text coverage is important to consumers. As shown in the 2019 Mobile Consumer Experience survey, inside the home is the location where consumers most use their mobile phones for voice, text and data and the area where they most experience service/coverage issues. For example:

- nearly 65% use their mobile phone for voice or text in the house daily⁷⁰⁴;
- about one third of all respondents experienced various service issues for calls/texts during the past month in the home,⁷⁰⁵ the highest of all locations assessed;
- the incidence of experiencing service issues in the home or part thereof for calls/text and data (c. 35%) is higher than the incidence of the same service issues that occur outside the home (c.17%)⁷⁰⁶;
- rural consumers experience higher rates of service issues regardless of location with higher levels of service issues arising in the home or part thereof (i.e. indoors).⁷⁰⁷

A 13.7 The four biggest service issues consumers experience all relate to voice calls rather than data usage. For example, of respondents who experienced service issues, 44% noted that the quality of reception deteriorated when on a call, 47% could not make a call, 36% could not receive a call and 35% experienced a dropped call.⁷⁰⁸ Similarly, service issues relating to text were experienced more frequently than for data usage.⁷⁰⁹ According to the survey, while consumers can experience connectivity issues regardless of their location, performance issues occur more frequently while indoors and

⁷⁰⁴ Mobile Consumer Experience Survey 2019, document 19/101, Slide 59.

⁷⁰⁵ Ibid, Slide 73.

⁷⁰⁶ Ibid, Slides 74, 81 & 82.

⁷⁰⁷ Ibid, Slides 74 & 75.

⁷⁰⁸ Ibid, Slides 87, 88, 89 & 90.

⁷⁰⁹ For example, 26% of service issues experienced indoors were related to being unable to send a text compared to 16% relating to being unable to use 4g data.

in more rural parts of the country.⁷¹⁰

A 13.8 As discussed in Chapter 7 of this document, ComReg is of the view that it is necessary to consider whether measures may be required in order to address consumers' indoor mobile voice and text connectivity issues noted above. Therefore, the purpose of this RIA is to consider what measures, if any, could be attached to spectrum rights of use in the Proposed Award in order to address concerns surrounding indoor mobile voice and text connectivity.

Objectives

A 13.9 The focus of this draft RIA is to assess the impact of the proposed measure(s) (i.e. various regulatory options) on stakeholders, competition and consumers. In that way, it allows ComReg to identify and implement the most appropriate and effective means to set appropriate obligations, while still allowing ComReg to achieve its objectives. In considering the above policy issue, ComReg is guided by what it considers to be the most relevant statutory objectives, including:

- to assign rights of use in accordance with the EC Decisions and other relevant legislation;
- to ensure that all end users, including disabled users, derive maximum benefit in terms of choice, price and quality;
- to encourage the efficient use and ensure the effective management of spectrum; and
- to ensure there is no distortion or restriction of competition in the electronic communications sector.

A 13.10 Of further relevance to the issue of voice obligations are:

- Decision (EU)2017/899⁷¹¹ for 700 MHz rights of use which, among other things, obliges Member States to:
 - take due account of the need to achieve the target speed and quality objectives set out in Article 6(1) of Decision No 243/2012/EU,

⁷¹⁰ Ibid, Slides 78 & 79.

⁷¹¹ DECISION (EU) 2017/899 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union.

- assess the need to attach conditions to the rights of use for frequencies within the 700 MHz frequency band and, where appropriate, to consult relevant stakeholders in that regard;
- The Mobile Phone and Broadband Taskforce [Focus Group Report on Mobile Coverage](#)⁷¹² set out recommended actions, including Action Point 39 to the effect that that “*All operators will introduce WiFi calling, VoLTE and other network feature and functionality enhancements at the earliest juncture and report on progress to the Taskforce Implementation Group.*” While this is a 2017 Action Point it remains important particularly since these network features and functionality enhancements remain unavailable for certain consumers.

A 13.11 ComReg’s overall powers, functions, duties and objectives in relation to the management of the radio frequency spectrum in Ireland are set out in Annex 2.

Identifying the regulatory options

A 13.12 ComReg has identified the following options:

- **Option 1** – Do not attach specific indoor mobile voice and text coverage and quality of service obligations.
 - This would mean that all licensees have full flexibility to choose the levels of mobile voice and text coverage and quality of service they would provide indoors.
- **Option 2** – Attach specific indoor mobile coverage and quality of service obligations to improve indoor mobile voice and text services.
 - This would involve an ‘Outdoor-In’ approach where the licensee would be obliged to provide a sufficient signal strength from outdoor base stations to penetrate indoors to ensure indoor mobile voice and text coverage replicates coverage provided outdoors.
- **Option 3** – Attach a Native Wi-Fi (including VoWi-Fi) obligation to rights of use to improve indoor mobile voice and text coverage and quality of service. Specifically:
 - If a licensee provides a mobile voice and/or text service using

⁷¹² MPBT - [Focus Group Report on Mobile Coverage](#)

rights of use in one or more of the Proposed Bands, then:

- i. it would be obliged use Native Wi-Fi technology on its network in respect of the Proposed Bands to which it holds rights of use to under its licence; and
- ii. it would be obliged to make available Native Wi-Fi voice and/or text services (as appropriate to the type of mobile service/s provided by the licensee) to all customers on its network (including third party customers, such as MVNO customers), where those customers:
 - have established for themselves a suitable Wi-Fi connection; and
 - have a Native Wi-Fi/Wi-Fi Calling-enabled mobile device.

Impact on stakeholders

A 13.13 There are a number of key industry stakeholders in relation to the matters considered in this chapter:

- existing MNOs;
- potential new entrants who do not currently provide voice or text services using spectrum in the State. This group may include companies that are already otherwise engaged in the electronic communications sector in the State, in other Member States or further afield; and
- MVNOs who may be reliant on MNOs for wholesale access.

A 13.14 The views of these stakeholders are assessed for each option below under the following headings.

- Mobile Network Operators (MNOs).
- MVNOs.
- Potential new entrants.

Option 1

MNOs

A 13.15 Under Option 1, MNOs would have full flexibility to choose how extensive

their indoor network coverage would be and what QoS standards would apply to indoor mobile voice calls and text. In that regard, MNOs may be of the view that the provision of outdoor coverage obligations would provide sufficient indoor coverage, and additional measures would be unnecessary to improve same. Alternatively, MNOs may be of the view that other technological solutions to improve indoor mobile voice and text coverage (for instance native Wi-Fi & repeaters) could be deployed by them without any specific obligation to provide for same.

A 13.16 However, given that nearly 65% of consumers use their mobile phone for voice or text in their homes daily,⁷¹³ MNOs may prefer some obligation to ensure that their consumers are able to make and receive calls from indoors (including to/from those on other networks who may otherwise have poor coverage). Given the on-going decline in fixed line usage,⁷¹⁴ MNOs are likely to have an increasing need from consumers to make indoor voice calls from their mobile device.

A 13.17 Certain operators have also made investments in providing for indoor mobile voice and text coverage already (See Option 3 below), however because a voice call requires a good connection at both ends, if another operator does not provide sufficient indoor mobile voice coverage then some of their consumers may be unavailable to all operators and their consumers regardless of any investments made. Further, even if connections can be made, the voice call QoS is likely to be significantly lower compared to a call made or received outdoors due to building penetration losses.⁷¹⁵

A 13.18 In the event that consumers experience a poor quality mobile voice call service, it is often not clear to consumers which network does not have a sufficient mobile voice call QoS standard. The 2019 Mobile Consumer Experience Survey shows that 27% of consumers choose their current provider based on their reputation and 15% based their decision on word-of-mouth about good coverage from that provider.⁷¹⁶ Therefore, MNOs would likely prefer that all operators had increased capability to receive calls and texts indoors in order to retain favourability with consumers.

A 13.19 In that regard, ComReg notes Vodafone's view that a Native Wi-Fi obligation is appropriate. Notwithstanding the above, in response to

⁷¹³ Mobile Consumer Experience Survey, Document 19/101, Slide 60.

⁷¹⁴ For example, fixed voice traffic in Q1 2019 was just over 620 million minutes, which was a 0.7% increase on Q2 2019 but a fall of 21.7% since Q3 2018 Source: Irish Communications Market Quarterly Key Data Report Data as of Q3 2019. Document 19/112.

⁷¹⁵ The Effect of Building Materials on Indoor Mobile Performance, published April 2018, Document 18/05.

⁷¹⁶ Mobile Consumer Experience survey, Doc 19/101, Slide 37.

Document 19/59R, Eir and Three both appeared to favour Option 1 whereby no specific obligations would be required to improve indoor mobile voice and text coverage. ComReg assesses Eir's claims that the provision of VoLTE and Native Wi-Fi services are competitive differentiators which ComReg should not eliminate in Chapter 7 and under 'Impact of competition' below.

New entrants

A 13.20 New entrants may prefer Option 1 if their network rollout plans (initially at least) focus on the provision of outdoor coverage. Under Option 1, new entrants would have the same flexibility as the MNOs in determining what level of indoor coverage to provide.

A 13.21 Alternatively, new entrants may be of the view that some obligation would be needed to provide good incentives for all operators to maintain a good indoor mobile voice call standard. New entrants may also be of the view that such conditions improve the perception of the network and such benefits are likely to exceed any compliance costs. Further, any measures to improve indoor mobile voice and text coverage could be introduced in tandem with the rollout of its network reducing long term costs.

A 13.22 Therefore, on balance new entrants would be unlikely to prefer Option 1.

MVNOs

A 13.23 MVNOs would likely prefer the option that maximises the indoor mobile voice call and text QoS that would be available to its consumers. Under Option 1, MVNOs would be exposed to the risk that consumers may consider its service to be inferior because either its host network or the receiving network cannot adequately provide for indoor mobile voice calls and texts. Further, MVNOs would be less likely to choose a host operator that provided poor indoor mobile voice and text coverage, reducing competition in the wholesale market for access.

A 13.24 Therefore, MVNOs would be unlikely to prefer Option 1.

Option 2

MNOs

A 13.25 Indoor mobile coverage obligations would require a licensee to provide coverage of a particular standard inside buildings. Option 2 would aim to achieve this through an 'outside-in' solution where the user receives a mobile signal from a network outside of the building i.e. from the existing outdoor network. However, MNO's are unlikely to prefer this option due to

the significant challenges that would need to be overcome, some of which are outside the control of the MNO.

- A 13.26 **First**, providing indoor mobile voice and text coverage using an 'outside in' solution would require a significantly densified network, which would entail significant costs,⁷¹⁷ in order to provide for penetration of buildings.
- A 13.27 A solution based on this approach could not be achieved rapidly, given the need to rollout additional base stations. Moreover, it would not be uniformly effective, given the variations in construction materials and building geometries as discussed in the Building Materials Report.⁷¹⁸ Given the evolution of building standards and variability of existing building stock any prediction or measurement of coverage would be fraught with difficulty and potentially provide a fertile ground for dispute.
- A 13.28 In effect, the required investment would likely be inefficient. In particular, and depending on the coverage level set, networks would need to provide for significant losses suffered by radio waves penetrating buildings, both on the up and down links to ensure effective indoor mobile coverage in most insulated buildings. This would require operators to significantly densify their networks without guarantee that the densification would have a positive impact on indoor mobile coverage, given practical difficulties such as obtaining access to measure indoors.
- A 13.29 **Second**, there is no guarantee that a densified outdoor network would provide good indoor mobile voice and text coverage, regardless of the number of additional base stations and cost of same (see below). There will always be some exceptional buildings with difficult construction material, few windows and/or shallow angle of incidence that outdoor solutions will have difficulty penetrating. All materials reduce the strength of signals to some extent but modern building materials that are designed to minimise heat increase the signal loss. The variation in building design and the use of efficient insulation materials means that in effect, an indoor mobile coverage obligation might provide a good reception for one house but not another even if they are in close proximity to each other.
- A 13.30 This issue is likely to be made more difficult in the future given the incentive for homeowners to install high levels of insulation in their homes e.g. energy efficiency grants. MNOs would find it increasingly difficult for mobile network

⁷¹⁷ The cost of network expansion is dominated by site CAPEX (i.e. civil works, acquisition) and OPEX. The Oxera Connectivity Report (Document 18/103c) estimates Capex of €250,000 per site and €15,000 Opex per annum.

⁷¹⁸ The Effect of Building Materials on Indoor Mobile Performance, published April 2018, Document 18/05.

signals to penetrate buildings due to the increasing requirement for better insulated houses to make an important contribution to the reduction of greenhouse gas emissions. For example, ComReg notes that since 2011 all new buildings required a minimum A3 BER rating and since 1 November 2019⁷¹⁹ the requirements to improve the energy performance of buildings has been increased to a minimum A2 BER.⁷²⁰

A 13.31 Further, where major renovations (defined as a renovation where more than 25% of the surface envelope of the building undergoes renovation) are carried out on a building, the building should achieve a cost optimal energy performance equivalent to a B2 BER. In effect, the new housing stock will be A2 rated and older stock not already subject to A3 standard will be upgraded over a period of time to a minimum B2 BER (up to 1.2 per cent of housing stock is renovated annually).⁷²¹

A 13.32 **Third**, it would be difficult to ensure that any indoor mobile coverage obligation is achieved in practice due to the difficulty in measuring indoor coverage. Indoor mobile coverage obligations are typically approximated by an outdoor drive test. This is done by estimating an additional margin depending on the penetration loss of the building materials (i.e. external wall, multiple indoor walls). However, as previously noted, mobile signal indoors can vary significantly between buildings and even between rooms within a single building, thus making it impractical to estimate a loss that would accurately reflect indoor mobile reception.⁷²² Therefore, even if operators are attempting to meet the obligations they may fall short of the desired levels of indoor mobile coverage, without realising, due to the difficulty measuring. Similarly, this makes it difficult to enforce from a regulatory perspective so would have limited effect in practice.

A 13.33 This view is supported by the ‘Connectivity Studies’ which were of the general view that an ‘outside-in’ approach was unlikely to be sustainable. For example:

- DotEcon notes that “it is not feasible to expect to address indoor coverage problems by setting tougher requirements on outdoor signal levels or extending the geographical area where outdoor

⁷¹⁹ European Union (Energy Performance of Buildings) Regulations 2019

⁷²⁰ <https://www.housing.gov.ie/housing/building-standards/energy-performance-buildings/energy-performance-buildings>

⁷²¹ <https://www.irishtimes.com/news/politics/new-energy-rules-for-home-renovations-and-extensions-1.4031816>

⁷²² Future Mobile Connectivity in Ireland - a report (Document 18/103c) from Oxera Consulting LLP (“Oxera”), with Real Wireless Ltd – p7, p3.

services must be available; this is unlikely to be a successful or sustainable solution.”;⁷²³

- Oxera notes that the ‘provision of indoor mobile connectivity can be promoted through complementary solutions other than mobile network roll-out, for example through Wi-Fi calling or mobile repeaters.’⁷²⁴ ; and
- Frontier notes that “providing guaranteed indoor connectivity using mobile networks is not practical or effective since mobile signal performance will vary.”.⁷²⁵

A 13.34 Further, the view that MNOs are unlikely to prefer Option 2 is supported by the response of stakeholders to Ofcom’s 2018 proposal for a ‘premises obligation’ in its consultation on coverage obligations in the 700 MHz spectrum band.

- BT/EE argued that a solution requiring the build of new macro sites might not be proportionate given the availability of alternative solutions, such as Native Wi-Fi calling.⁷²⁶
- Vodafone suggested that other technologies could be used to deliver indoor mobile coverage, whilst noting that the cost per premises of such an obligation could be high.⁷²⁷
- O2 noted that the costs for an indoor mobile coverage obligation would be highly dependent on the specific premises involved and coverage requirements, and that this presented a challenge for further cost analysis.⁷²⁸
- BT/EE also said it was concerned that “a cost benefit analysis is unlikely to be positive for rolling out indoor coverage where customers have outdoor mobile coverage and a good fixed broadband service”.⁷²⁹

A 13.35 Therefore, ComReg is of the preliminary view that MNOs are unlikely to

⁷²³ Coverage obligations and spectrum awards a report from DotEcon Ltd, Document 18/103d – p9.

⁷²⁴ Future Mobile Connectivity in Ireland – a report, Document 18/103c from Oxera Consulting LLP with Real Wireless Ltd – p.7.

⁷²⁵ Frontier Economics, Meeting Consumers’ Connectivity Needs” – a report (Document 18/103b) - p45.

⁷²⁶ <https://www.ofcom.org.uk/consultations-and-statements/category-2/700-mhz-coverage-obligations>

⁷²⁷ Ibid

⁷²⁸ Ibid

⁷²⁹ Ofcom, Award of the 700 MHz and 3.6-3.8 GHz spectrum bands, Annex 17.

prefer Option 2.

New entrants

A 13.36 New entrants would face similar challenges to MNOs as set out above. Therefore, ComReg is of the preliminary view that Option 2 is unlikely to be preferred by new entrants.

MVNOs

A 13.37 While it is possible that MVNOs would prefer Option 2 due to the benefits from the increased signal strength from additional base stations, the cost would likely be passed on in the form of higher wholesale access charges. Further, this higher cost would represent poor value in the provision of indoor mobile voice and text coverage as there would always remain consumers who would not receive sufficient indoor mobile coverage.

A 13.38 Therefore, ComReg is of the preliminary view that MVNOs are unlikely to favour Option 2.

Option 3

MNOs

A 13.39 As described above, MNOs may prefer an obligation to provide indoor mobile voice and text coverage due to the importance of indoor voice calls and texts to their customers and the damage to their reputation caused by a lack of consistent voice call quality across different networks. However, as already noted, an 'outside in' obligation is likely to prove too costly and not be effective in providing indoor mobile voice and text coverage on a consistent basis. In that regard, Native Wi-Fi provides a number of benefits to MNOs over Option 2, including:

- It provides an effective and cost efficient means of providing consumers with indoor mobile voice and text coverage.
- If operators already intend to rollout VoLTE they will have already deployed an IP Multimedia System⁷³⁰ and the costs of introducing Native Wi-Fi will be marginal.⁷³¹

⁷³⁰ The IP Multimedia Subsystem (IMS) provides the technical means for operators to transfer core services (voice, video and messaging) to an all-IP LTE environment.

⁷³¹ VoLTE / VoWiFi — capacity, reach, and capability Deloitte Consulting

<https://www2.deloitte.com/ie/en/pages/technology-media-and-telecommunications/articles/tmt-pred16-telecomm-volte-vowifi-capacity-reach-capability.html>

- Native Wi-Fi provides seamless handover with LTE as the 3GPP defines interfaces between the LTE core network and the Wi-Fi network, meaning Native Wi-Fi can be offered alongside VoLTE to compliment the operator's voice service.⁷³²
- Native Wi-Fi offers a consistent voice quality experience comparable to VoLTE (12.65 kbps) meaning the associated QoS would be superior to calls currently made/received on 2G/3G networks.⁷³³
- Native Wi-Fi provides for indoor mobile voice and text coverage using Wi-Fi frequencies freeing-up the usage of the operators' own frequencies to provide more capacity for outdoor calls, text and data use.

A 13.40 Further, MNOs will over time be able to provide near ubiquitous indoor mobile voice and text coverage⁷³⁴ which would not be possible under Option 2 (as some parts of the outdoor population will always be unserved by mobile⁷³⁵). In particular, the rollout of NBP should see access to high speed broadband services being made available to all businesses and households in Ireland which would allow consumers to take advantage of improved broadband connectivity indoors. Further, the natural replacement cycle of phones should allow most consumers to be able to benefit from Native Wi-Fi over a relatively short period. Around 10% of consumers have phones that are over 5 years old.⁷³⁶ These older phones are less likely to have this capability.⁷³⁷

A 13.41 Finally, ComReg notes that two MNO's (Vodafone⁷³⁸ and Eir⁷³⁹) are already offering Native Wi-Fi calling in Ireland. Three is continuing to evaluate the potential introduction of Wi-Fi calling,⁷⁴⁰ but ComReg notes that Three is providing Native Wi-Fi over its network in the UK⁷⁴¹. Further, given Three's public commitments to introduce VoLTE in Ireland, the rollout of Native Wi-

⁷³² Einashar, A & A. El-Saidny, M (2018), 'Practical Guide to LTE-A, VoLTE and IoT: Paving the way towards 5G: 1st Edition' Wiley, p212 – 213, p7-8

⁷³³ Ibid

⁷³⁴ Subject to consumers having broadband and Wi-Fi that provides effective coverage throughout their homes.

⁷³⁵ In that regard, ComReg has set a precautionary outdoor coverage obligation of 95%.

⁷³⁶ Mobile Consumer Experience Survey 2019, Document 19/101 slide 46.

⁷³⁷ For example, Eir customers with Samsung phones only have native Wi-Fi capability if their handset model was released after the Samsung S6 (2015). <https://www.eir.ie/wificalling/>

⁷³⁸ <https://n.vodafone.ie/network/wi-fi-calling.html>

⁷³⁹ <https://www.eir.ie/wificalling/>

⁷⁴⁰ Mobile Phone & Broadband Taskforce Implementation Review 2018, p23.

⁷⁴¹ http://www.three.co.uk/discover/Three_inTouch/ios-wifi-calling

Fi is unlikely to impose additional significant costs on Three.

- A 13.42 Notwithstanding, in response to Document 19/59R, Three stated it did not agree with the proposal to include a Native Wi-Fi calling obligation and submits that ComReg should let licensees decide whether or when it is most appropriate to introduce this service (e.g. when they are sure that the customer experience will be as good as it is with circuit-switched voice).
- A 13.43 While Eir does not favour a Native Wi-Fi obligation in its response to Document 19/59R as it views it as a 'competitive differentiator' (discussed below), it is likely that it would prefer Option 3 to Option 2 as the costs are significantly lower.
- A 13.44 Vodafone in its response to Document 19/59R stated that it believes a Native Wi-Fi obligation is useful to promote the best services to customers. Therefore, Vodafone would likely prefer Option 3 for the reasons stated above.
- A 13.45 Therefore, while all MNOs are unlikely to prefer Option 2, they are likely to have differing positions regarding Options 1 or 3 depending on their own commercial strategies.

New entrants

- A 13.46 A Potential new entrant is likely to prefer an option which gives it maximum flexibility in its choice of business model in line with its commercial strategy and therefore Option 1 could be preferred over Option 3. However, as noted in the draft 'Voice Call Services' RIA' in Annex 12 such an entrant would be unlikely to rollout a 2G/3G network to provide voice services, rather it would likely rollout VoLTE in tandem with the rollout of its network more generally in order to provide voice services.
- A 13.47 As previously noted, the costs associated with rolling out Native Wi-Fi when VoLTE is already provided are low and new entrants would therefore likely provide Native Wi-Fi services along with VoLTE.
- A 13.48 Consequently, ComReg is of the preliminary view that new entrants are likely to favour Option 3.

MVNOs

- A 13.49 MVNOs would likely prefer the option that maximises the amount of services that would be available to its consumers. In that regard, MVNOs would likely prefer Option 3 as this would provide indoor mobile voice and text coverage sooner and across a greater number of consumers than either Option 1 or Option 2.

A 13.50 Therefore, ComReg is of the preliminary view that MVNOs are likely to favour Option 3.

Impact on competition

Option 1

A 13.51 Competition in the retail mobile communications market is multi-faceted and operators compete across a range of factors including, price, handsets, bundles, and coverage. Network operators have clear competitive incentives to improve indoor mobile voice and text coverage in order to attract new subscribers and increase the benefits of all subscribers using the network. However, consumers report indoor mobile voice and text coverage issues across all operators (23% of consumers are dissatisfied with indoor mobile voice text, and data connectivity)⁷⁴² illustrating the difficulty all operators have in improving indoor mobile coverage.

A 13.52 Under Option 1, operators would retain flexibility on how to best optimise their network to improve indoor mobile voice and text coverage. The release of the 700 MHz Band and the associated coverage obligations could improve indoor mobile voice and text coverage to some degree but this would still be significantly curtailed due to the difficulties a mobile network signal has penetrating indoors, particularly with modern building materials, as discussed above. Alternatively, MNOs would be able to deploy other technological solutions. For example, mobile phone repeaters can be deployed by MNOs as part of managing ongoing network performance. More pertinently, as noted above, Vodafone and Eir have already rolled out Native Wi-Fi as a means of improving mobile voice and text coverage for consumers.

A 13.53 Given the importance attached to indoor mobile voice calls and texts by consumers, normal competitive forces should encourage MNOs to provide sufficient levels of indoor mobile voice and text coverage (as demonstrated by recent initiatives by Eir and Vodafone). Thus, it may not be necessary to impose any obligation to improve indoor mobile coverage. However, even in competitive markets there is no guarantee that competition will deliver and maintain an acceptable level of indoor mobile voice and text coverage across the country. It cannot be ruled out that such measures would not be provided for all consumers and across all operators. In particular, operators (including new entrants) may decide to focus on data (e.g. low cost unlimited data plans) to capture market share rather than improvements to indoor mobile voice coverage (which would also impact other operators).

⁷⁴² Mobile Consumer Experience Survey 2019, Document 19/101, Slide 94.

A 13.54 Even where competition between MNOs takes place it may not prevent certain customers being disadvantaged by inefficient and/or poor quality services. In some cases, it is helpful to attach licence conditions which reassure network operators that they will not face the risk of one or more operators compromising the ability of the market to deliver a benefit to consumers across the entire market. This may maintain incentives for those operators to invest in infrastructure to promote indoor mobile coverage improvements and ensure the efficient use of the radio spectrum.

A 13.55 Option 1 maintains the status quo and to date appears to have delivered sub-optimal indoor mobile voice and text coverage outcomes to the detriment of consumers. There is no reason to assume that this position would change materially in the absence of intervention. Therefore, ComReg is mindful that Option 1 is not an appropriate solution to the indoor mobile coverage issues described above.

Option 2 v Option 3

A 13.56 ComReg assesses the relative impact of Option 2 and Option 3 under the following headings.

- distortions to the spectrum award;
- efficient investment;
- efficient use of the radio spectrum;
- new entry; and,
- competitive differentiation.

Potential distortions to the spectrum award

A 13.57 Under Option 2, an 'outside in' obligation designed to improve indoor mobile voice and text coverage would run the risk of extending outdoor coverage beyond the limits that competition alone might deliver. In particular, given the difficulties associated with providing indoor mobile coverage from outside, operators are already likely to be close to the limits of what can be delivered indoors⁷⁴³ using external base stations as any additional base stations would only be cost effective in delivering competitive outdoor coverage as described in the Oxera Report.

A 13.58 In effect, any 'outside in' obligation would likely go beyond what operators

⁷⁴³ Dissatisfaction with indoor mobile voice and text connectivity is broadly consistent across all MNOs.

would be willing to provide commercially as the number of base stations required would significantly exceed the number of base stations required to provide outdoor coverage as described in the 'Coverage' RIA. Such obligations are referred to as 'interventionist coverage obligations' and are discussed in Chapter 7 and in the draft '700 MHz Coverage' RIA in Annex 9. Depending on the form and manner of such an obligation, it may distort spectrum awards and reduce competition in a number of ways. These are discussed in detail in the draft '700 MHz Coverage' RIA and are not repeated here. Alternatively, Option 3 would run little risk of distorting the spectrum award as Native Wi-Fi is likely to be provided commercially.

A 13.59 Similarly, raising the power limits on individual base stations would not be prudent as it would be unlikely to remedy indoor mobile voice and text coverage and/or it could create unintended consequences. For example, base stations should be optimised to provide coverage efficiently, however, indiscriminately raising the power limits in an attempt to address indoor mobile coverage would likely create inter-cell interference compromising outdoor mobile coverage. Although it is possible that raising the power limits would partially remedy indoor mobile coverage issues with regard to downlink (albeit with the unintended consequences mentioned), it would in no way solve any issues for indoor uplink connectivity. This is because uplink connectivity is limited by the handset used and will not be improved by indiscriminately raising individual base station limits.

Efficient investment

A 13.60 Option 2, as noted above, would require the rollout of additional base stations substantially increasing the costs associated with providing indoor voice coverage. Alternatively, Option 3 would promote efficient investment and innovation in new and enhanced infrastructures by avoiding investments that would otherwise be incurred in rolling out additional sites, where those sites are not required for coverage and capacity purposes. Further, Option 3 would be more beneficial for consumers (see impact on consumers below). In that regard, Option 3 would be a less onerous, more effective and more proportionate means by which ComReg could achieve its objectives.

Efficient use of the radio spectrum

A 13.61 A key objective in designing and carrying out this award process is to encourage the efficient use and ensure the effective management of the radio frequency spectrum in order to promote competition and maximise the benefits for consumers in terms of price, choice and quality. In that regard, an 'outside in' obligation would likely result in the inefficient use of the radio spectrum in a number of ways.

- A 13.62 **First**, the additional base stations would be rolled out to increase the possibility of mobile signals penetrating indoors. However, the rollout of additional base stations would result in the over provisioning of the network outdoors, essentially creating capacity outdoors where no such demand exists. This could be particularly inefficient in rural areas with low population densities. Further there is no guarantee the use of the radio spectrum in this way would be effective in providing indoor mobile coverage.
- A 13.63 **Second**, in order to satisfy the indoor mobile coverage obligation, MNOs could divert resources that would otherwise be deployed to deliver capacity, where it is actually required or improved services. This could be particularly damaging to competition if MNOs are unable to deploy spectrum resources where they are needed most and respond to rivals or the needs of its consumers in particular areas.
- A 13.64 **Third**, operators can typically identify areas of their network that require additional capacity and either add new sites or spectrum. In effect, scarce spectrum resources can be efficiently targeted at areas that require additional capacity or coverage the most. However, in providing for the rollout of additional indoor mobile voice and text coverage, MNOs would find it difficult to determine whether any additional base stations would (a) penetrate a sufficient number of homes and (b) whether those homes even need improvements in indoor mobile voice and text connectivity as these homes could already be receiving adequate indoor mobile coverage. In effect, MNOs are somewhat blind as to the effect of rolling out additional base stations in particular areas for indoor mobile voice and text coverage.
- A 13.65 Alternatively, Option 3 would provide full flexibility for MNOs to utilise their resources in line with the demand for services in all areas. Further, the provision of voice services using Native Wi-Fi utilises the Wi-Fi frequency ranges (i.e. 2.4 GHz and 5 GHz). This reduces the load on the mobile network and makes licensed rights of use more available for the provision of data services. This is likely to be particularly beneficial in higher density areas where capacity constraints could arise and need to be managed. In this way, it would promote the efficient use of the radio spectrum by allowing services to be delivered efficiently using both the operators licenced spectrum and the Wi-Fi frequencies and facilitating the rollout of mobile networks in an efficient manner.

New entry

- A 13.66 Option 2 would also be unlikely to encourage new MNO entry. While ComReg could include an appropriately reduced indoor mobile coverage obligation for such entrants, any obligation that does not appear proportionate to potential entrants creates long run uncertainty about the

nature of regulation discouraging new entry. Alternatively, as noted above, Option 3 would be dimensioned to provide integrated VoLTE and Native Wi-Fi services.

Competitive differentiation

- A 13.67 In that regard, ComReg would note that while such an obligation might appear unnecessary, given that two operators have already rolled out Native Wi-Fi (for some, but not all customers) and the same outcome for indoor mobile voice and text coverage could be achieved through normal competition, Option 3 can play an important role in protecting potential risks to competition as described above.
- A 13.68 ComReg notes that Option 3 would not involve ComReg eliminating competitive differentiation (as submitted by Eir), rather, ComReg would be providing protection that an important service that satisfies a clear consumer need and that would be expected anyway from well-functioning competition between network operators would be delivered over an appropriate period. This is supported by the stakeholder analysis above and operator's commitment to the rollout of Native Wi-Fi. In effect, such an obligation is little different to precautionary coverage obligations which may be met or exceeded by operators but play an important role in preventing any competitive distortions.
- A 13.69 As noted by DotEcon,⁷⁴⁴ "if all networks were not timely in offering native Wi-Fi calling, despite the population of enabled handsets growing, this would prima facie suggest a possible competitive failure". These possibilities may not be likely to arise, however Option 3 would provide reassurance in preventing such adverse outcomes, with little risk of the obligation itself creating unintended distortions or imposing costs.
- A 13.70 In light of the above assessment, ComReg is of the preliminary view that Option 3 would better promote competition.

Impact on consumers

Option 1

- A 13.71 Indoor mobile voice and text coverage is a key issue for consumers. Further, ComReg notes that consumer experience with regard to voice coverage has deteriorated since 2017. In 2019, 33% of consumers have experienced coverage issues throughout the home compared to 28% in

⁷⁴⁴ Document 18/103d, 'Coverage obligations and spectrum awards a report from DotEcon Ltd, published November 2018 – Section 2.2.2.

2017⁷⁴⁵ and issues with regard to calls indoors are higher than for data or text (58% compared to 21% and 16% respectively)⁷⁴⁶.

- A 13.72 Given the above, it is unlikely consumers would favour Option 1 as this would reinforce the status quo which up to this point has not provided sufficient indoor mobile voice and text coverage. Consumers would receive some indoor mobile coverage benefits from the outdoor coverage obligation, as outdoor coverage would penetrate indoors to a certain extent. However, as noted above, it would make little difference to the large and increasing cohort of consumers who make use of better building insulation materials (e.g. foil-backed insulation, windows with metallic components and coatings, etc.) and the consequent reduction in indoor signal penetration. Further, under this option consumers would potentially have to sacrifice indoor mobile connectivity for more energy efficient homes.
- A 13.73 While two of the three operators are currently offering Native Wi-Fi services, these are only available across selected plans. Further, as noted above ('Impact on competition') there remains a risk that the rollout of Native Wi-Fi to all consumers and operators could be delayed absent measures to encourage same. Therefore, consumers are likely to welcome measures that could encourage the timely and effective rollout of measures that would improve indoor mobile voice and text coverage.

Option 2

- A 13.74 Consumers might prefer Option 2 if they were of the view that this approach would remedy the ongoing indoor mobile voice and text coverage issues, in a timely manner with little increase in prices. However, as noted earlier (Impact on Stakeholders) an 'outside in' obligation is unlikely to be effective or timely and there is a risk that the MNOs would be unable/unwilling to meet the obligations due to the excessive costs and uncertainty. Furthermore, as noted above, while such an obligation may improve the indoor mobile coverage experience for some consumers there would always be others without indoor mobile voice and text coverage due to indoor penetration issues that could not be overcome regardless of network densification.
- A 13.75 Further, under Option 2, the significant additional costs of network densification could be passed onto consumers or alternatively other more valued services would not be provided or provided to a lesser degree (e.g. better outdoor coverage, QoS, handsets). Consumer surveys suggest a

⁷⁴⁵ Mobile Consumer Experience survey 2019, document 19/101, Slide 73.

⁷⁴⁶ Ibid, Slide 87.

very limited willingness to pay⁷⁴⁷ for coverage enhancement, which is unsurprising given coverage problems fall disproportionately on a subset of consumers (i.e. all consumers would be required to pay for indoor mobile coverage issues experienced by some and there is no guarantee that those coverage issues would be resolved). More generally, consumers are unlikely to favour an option that results in the unnecessary rollout of additional mobile sites and towers across the country. Further, similar to above, under this option consumers would have to sacrifice indoor mobile coverage for more energy efficient homes.

A 13.76 Therefore, ComReg is of the preliminary view that consumers are unlikely to prefer Option 2.

Option 3

A 13.77 ComReg observes that the ability to use Native Wi-Fi is likely to be the most effective mechanism to improve indoor voice and text coverage in the long run. In that regard, Native Wi-Fi offers a number of benefits to consumers, including that it:

- offers a voice quality above what is currently provided by 2G/3G and an experience comparable to VoLTE (12.65 kbps).
- should provide near universal indoor mobile voice coverage in line with the rollout of the NBP.
- offers a seamless user experience for mobile voice and text messaging and can use Wi-Fi calling at any location (e.g. work or at home) that has suitable Wi-Fi access.
- does not require the installation of mobile phone repeaters or specialised equipment/base stations. It only requires that consumers have access to Wi-Fi over a broadband connection and Wi-Fi calling enabled phones.⁷⁴⁸
- does not require consumers to sacrifice indoor mobile coverage for more energy efficient homes as could be the case under Option 1 and Option 2.

⁷⁴⁷ The Mobile Consumer Experience survey 2017 has shown that the majority of consumers (especially those in urban areas who would not benefit from the obligations) have a low willingness to pay for improved coverage. Consumers in urban areas would be willing to pay on average only an additional €1.50 a month to improve indoor coverage. Document 17/100a, slide 78.

⁷⁴⁸ This feature is typically available on smartphones of 2 years old or less.

- is unlikely to result in additional charges to consumers as the costs of meeting this obligation should be minimal, particularly if VoLTE is already planned or deployed.

A 13.78 Further, greater availability of Public Wi-Fi in areas of existing low connectivity will allow consumers to make voice calls over such networks. For example, as part of the Mobile Broadband Taskforce, the BCP (Broadband Connection Points) programme, will provide free public Wi-Fi access at 300 locations nationwide within the amber intervention area.⁷⁴⁹ Through the Digital Innovation Programme (DIP), the government has provided funding to a number of initiatives around the country that provide Wi-Fi services to the public free of charge.⁷⁵⁰

A 13.79 Finally, it provides consumers greater transparency over the source of any connectivity issues (i.e. if a consumer is aware of the benefits of Native Wi-Fi and indoor mobile voice experience is still poor, it is more likely to be a result of issues related to the other caller).

A 13.80 ComReg would note that a number of factors lie outside the control of the mobile operators, including that certain consumers:

- regardless of mobile operator, do not have a Native Wi-Fi enabled mobile device;
- particularly rural consumers, may not have an internet connection sufficient to benefit from Wi-Fi calling regardless of operator or handset availability; and
- may not have access to the internet at all. For example, 9% of households do not have internet access.⁷⁵¹

A 13.81 However, these reasons seem likely to become less relevant over time although certain households may never choose to have internet access. In particular, the National Broadband Plan (“NBP”) is a Government wide initiative to deliver access to high speed broadband services to all businesses and households in Ireland. Over the same period, the natural replacement cycle of phones should allow most consumers to be able to benefit from Native Wi-Fi. However, in the meantime the use of repeaters is likely to be of benefit to those consumers who face mobile reception

⁷⁴⁹ https://www.dccae.gov.ie/documents/2019_05_21%20Q1%202019%20Taskforce%20Report.pdf

⁷⁵⁰ [ibid](#)

⁷⁵¹ Information Society Statistics - Households 2019

<https://www.cso.ie/en/releasesandpublications/ep/p-isshh/informationstatistics-households2019/householdinternetconnectivity/>

issues indoors.

A 13.82 Therefore, in light of the above, ComReg is of the view that consumers would likely prefer Option 3 over Option 1 and Option 2.

Overall Preferred Option

A 13.83 In light of the above, ComReg is of the preliminary view that Option 3 is the overall preferred option because, among other things it would:

- improve indoor voice and text **coverage**:
 - By using the most effective radio frequencies for indoor connectivity (i.e unlicensed Wi-Fi spectrum bands inside the home), it would provide better indoor coverage levels compared to Option 2 which would use “outdoor” mobile spectrum which would suffer significant penetration loss because of, among other things, modern building materials and therefore have lower levels of indoor voice and text coverage;
 - further, the coverage advantages of Option 3 over Option 2 identified above are likely to increase over time as more existing homes are retrofitted with modern building materials, new homes required to be built with modern building materials, and any changes to the Building Regulations which would increase penetration loss from outdoor signals;
- improve indoor (and outdoor) voice and text **quality of service**:
 - By using the most effective radio frequencies for indoor coverage (i.e unlicensed Wi-Fi spectrum bands), it would provide better indoor coverage levels and, by implication, quality of service compared to Option 2 which would use “outdoor” mobile spectrum which would suffer penetration loss because of, among other things, modern building materials and therefore have lower levels of indoor voice and text quality of service;
 - the relevant “outdoor” mobile spectrum which would have otherwise been used to attempt to provide the (poorer) indoor voice or text service is now freed (by virtue of W-iFi offload) and this additional capacity can therefore be used to provide a better quality of service to a licensee’s **outdoor** customers;

- it would avoid requiring handsets operating at increased power in attempting to make a connection with outdoor base stations (under Option 2) - noting also that there is also an inherent limitation in this regard; and
- it offers a voice quality above what is currently provided by 2G/3G and an experience comparable to VoLTE (12.65 kbps).
- promote the **effective and efficient use of frequencies**:
 - it would make more *effective* use of radio frequencies by entailing the use of the frequencies best suited to providing indoor voice and text connectivity (i.e. unlicensed Wi-Fi spectrum in within the premises);
 - it would make more *efficient* use of the unlicensed Wi-Fi spectrum bands, which may be relatively less congested than the relevant “outdoor” mobile frequencies (including the frequencies relevant to the Proposed Award) that would otherwise be used to provide the indoor voice and text service;
 - it would make more *effective* use of radio frequencies by entailing the use of the frequencies best suited to providing outdoor mobile services (i.e. the mobile frequencies, including the frequencies relevant to the Proposed Award);
 - it would make more *efficient* use of the relevant “outdoor” mobile spectrum because they would be freed from providing (poorer) indoor voice or text services (by virtue of Wi-Fi offload) and this additional capacity can be used to provide the outdoor mobile services to which it is better suited; and
 - it would avoid the inefficient investment and inefficient spectrum use (i.e. additional base stations being deployed for the “outdoor” mobile bands and/or operating at potentially higher power levels in an attempt to deliver an attenuated signal indoors) that would otherwise be incurred in trying to provide a (poorer if at all) indoor voice and text service with such frequencies.
- More generally, and in light of the above, Option 3 would:
 - better reflect the increasing availability of high-speed Wi-Fi networks and, indeed, the impending roll-out of the NBP means that Option 3 could provide the above identified benefits across the entire population;

- in light of the above, better ensure that users derive maximum benefit in terms of choice, price and quality;
- better support increasing the energy efficiency of mobile networks and of mobile users, noting in particular the challenges with mobile battery usage;
- be unlikely to result in a distortion or restriction of competition to the detriment of users; and
- would be suitable for the achievement of the legitimate objectives as there do not appear to be less onerous means by which these objectives and principles could be achieved.

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Annex: 14 Technical conditions

A14.1 Introduction

- A 14.1 In line with its consideration of the technical conditions in Chapter 7 of this document, ComReg sets out in this Annex its proposed technical conditions for the 700 MHz Duplex, the 2.1 GHz Band, the 2.3 GHz Band and the 2.6 GHz Band in accordance with the relevant EC Decisions, and in the case of 2.3 GHz, the relevant ECC Decision.
- A 14.2 Any bidder that successfully acquires spectrum rights of use in the Proposed Award Process would be obliged to comply with the technical requirements set out below, these technical conditions include:
- in-block power limits for both base station and terminal station;
 - out-of-block power limits which detail baseline power limits;
 - transitional region power limits; and
 - guard band emission limits (specifically for FDD channelling arrangement)

A14.2 MFCN Cross Border Compatibility

- A 14.3 ComReg has engaged with neighbouring administrations particularly with Ofcom in the UK to agree cross border arrangements to include the deployment of MFCN/ECS in the Proposed Bands. These cross border agreements take the form of a Memorandum of Understanding (MoU)⁷⁵² and aim to cater for the deployment of both 4G and 5G services, taking into account the latest CEPT reports regarding cross border coordination of these systems.
- A 14.4 Any bidder that successfully acquires spectrum rights of use in the Proposed Award Process would be obliged to comply with the technical requirements set out in the corresponding MoU, including coordination thresholds and corresponding procedures.

⁷⁵² [Cross border Memorandum of Understanding \(MoU\)](#)

A14.3 The 700 MHz Duplex Band

In-block Power limits

Base station power limits:

A 14.5 ComReg proposes to set the in-block power limit to 64dBm/5MHz, given that this limit is considered sufficient for the provision of likely services within the band. This in-block power limit would be applicable to all base stations within the operators' assigned blocks.

Out-of-Block Power Limits

Baseline Power Limits

A 14.6 ComReg proposes to award the 700 MHz band in 5 MHz blocks in line with a measurement bandwidth of 5 MHz⁷⁵³ outlined in the EC Decision. ComReg proposes to apply this measurement bandwidth to out-of-block emissions in both the uplink blocks in the range of 703-733 MHz and the downlink blocks in the range of 758-788 MHz. The base station baseline power limit would apply as follows:

- for uplink frequencies in range 698-736 MHz, a maximum mean EIRP limit of -50 dBm per cell⁷⁵⁴ across a 5 MHz measurement bandwidth shall apply;
- for uplink frequencies as defined in Decision 2010/267/EU (i.e. 832-862 MHz), a maximum mean EIRP limit of -49 dBm per cell across a 5 MHz measurement bandwidth shall apply;
- for downlink frequencies in the range 738-791 MHz, a maximum mean EIRP of 16 dBm per antenna across a 5MHz measurement bandwidth shall apply;
- for downlink frequencies as defined in Decision 2010/267/EU (i.e. 791-821 MHz), a maximum mean EIRP limit of 16 dBm per antenna across a 5 MHz measurement bandwidth shall apply; and
- for frequencies below 694 MHz where DTT broadcasting is protected, a maximum mean EIRP limit of -23 dBm per cell across an 8 MHz measurement bandwidth is required.

⁷⁵³ The 700 MHz EC Decision also provides for a measurement bandwidth of 3 MHz or 200 kHz for the protection of block size of 3 MHz depending on the national implementation options.

⁷⁵⁴ In a multi-sector site, the value per "cell" corresponds to the value for one of the sectors.

Transitional Power Limits

A 14.7 The proposed transitional power limits for downlink only blocks in the frequency range 733 – 788 MHz are as follows:

- for -10 to -5 MHz offset from lower block edge or 5 to 10 MHz offset from the upper block edge, a limit of 18 dBm maximum mean EIRP per antenna shall apply across a 5 MHz measurement bandwidth; and
- for -5 to 0 MHz offset from lower block edge or 0 to 5 MHz offset from the upper block edge, a limit of 22 dBm maximum mean EIRP per antenna shall apply across a 5 MHz measurement bandwidth.

A 14.8 For a block in frequency range 788-791 MHz, with an upper edge at:

- 788 MHz, a 21 dBm maximum mean EIRP limit per antenna shall apply across a 3 MHz measurement bandwidth;
- 783 MHz, a 16 dBm maximum mean EIRP limit per antenna shall apply across a 3 MHz measurement bandwidth;
- 788 MHz for protection of systems with bandwidth < 3 MHz, a 11 dBm maximum mean EIRP limit per antenna shall apply across a 200 kHz measurement bandwidth; and
- 783 MHz for protection of systems with bandwidth < 3 MHz, a 4 dBm maximum mean EIRP limit per antenna shall apply, across a 200 kHz measurement bandwidth.

A 14.9 For a block in the frequency range 791-796, with upper edge at:

- 788 MHz, a 19 dBm maximum mean EIRP limit per antenna shall apply across a 5 MHz measurement bandwidth; and
- 791-796 MHz for a block with upper edge at 783 MHz, a 17 dBm maximum mean EIRP limit per antenna shall apply across a 5 MHz measurement bandwidth.

A 14.10 For a block in the frequency range 796-801 MHz, with upper edge at 788 MHz, a 17 dBm maximum mean EIRP limit per antenna shall apply across a 5 MHz measurement bandwidth.

Guard Band Base Station Power Limits

A 14.11 ComReg proposes to implement base station limits for part of the guard bands not used for PPDR or M2M radio communications, i.e. 694-703 MHz

and 788-791 MHz in accordance with the EC Decision. The following power limits proposed to be implemented are:

- A maximum mean EIRP limit of -32 dBm per cell across 1 MHz shall apply to spectrum between the lower band edge of the 700 MHz frequency band and FDD uplink lower band edge (i.e. 694-703 MHz); and
- A maximum mean EIRP limit of 14 dBm per antenna across 3 MHz shall apply to spectrum between FDD downlink upper band edge and the FDD downlink lower band edge as defined in Decision 2010/267/EU (i.e. 788-791 MHz).

Duplex Gap Power limit

A 14.12 A base station power limit is defined in the 700 MHz EC Decision for part of the duplex gap not used for PPDR or M2M. Although provision for these services in the paired frequency range 733-736 / 788-791 MHz has not been made as part of this process, the following power limits of the duplex gap (733-738 MHz), in line with the 700 MHz EC Decision. These limits are proposed to be implemented as follows:

- for – 10 to 0 MHz offset from FDD downlink lower band edge or lower edge of the lowest downlink-only block, but above FDD uplink upper band edge, a 16 dBm maximum mean EIRP limit per antenna shall apply across 5 MHz; and
- for more than 10 MHz offset from FDD downlink lower band edge or lower edge of the lowest downlink-only block, but above FDD uplink upper band edge, a – 4 dBm maximum mean EIRP limit per antenna shall apply across 5 MHz.

Terminal station

Terminal station in-block power limit

A 14.13 The 700 MHz EC Decision defines a maximum mean in-block power limit of 23 dBm⁷⁵⁵ for terminal stations. The proposed in-block power limit may be relaxed in certain situations including for fixed terminal stations in rural areas provided that protection of other services, networks and applications is not compromised and cross-border obligations are fulfilled.

⁷⁵⁵ This value is subject to a tolerance of up to +2 dB, to take account of the operation under extreme environmental conditions and production spread.

Terminal station out-of-block (lower edge) power limit

A 14.14 A Total Radiated Power⁷⁵⁶ (TRP) limit for terminal stations operating in the uplink band (i.e. 703-733 MHz) applicable to the guard band between the upper limit of spectrum used for television broadcasting (694 MHz) and FDD uplink (694-703 MHz) and used for television broadcasting (below 694 MHz) is implemented as follows:

- for 694-698 MHz, a -7 dBm maximum mean out-of-block EIRP across 4 MHz;
- for 698-703 MHz, a 2 dBm maximum mean out-of-block EIRP across 5 MHz; and
- for 470-694MHz, a -42 dBm maximum mean out-of-block power across 8 MHz.⁷⁵⁷

Terminal station out-of-block (upper edge/duplex gap) power limit

A 14.15 The terminal station power limits for the duplex gap between FDD uplink and FDD downlink:

- for 733 -738 MHz, a 2 dBm maximum mean out-of-block EIRP across 5 MHz;
- for 738-753 MHz, a -6 dBm maximum mean out-of-block EIRP across 5 MHz; and
- for 753-758 MHz, a -18 dBm maximum mean out-of-block EIRP across 5 MHz.

A 14.16 ComReg notes that the derived spectrum mask described above is specified in clause 4.2.3 of ETSI EN 301 908-13 v6.2.1⁷⁵⁸ which ensures that LTE based equipment would inherently comply with these limits.

⁷⁵⁶ TRP is a measure of how much power the antenna actually radiates. The TRP is defined as the integral of the power transmitted in different directions over the entire radiation sphere.

⁷⁵⁷ If an applicant were to win more than 10 MHz of spectrum in the 700 MHz Duplex band, refer to Chapter 5, paragraph 5.51 of this document which outlines the applicable licence obligations.

⁷⁵⁸ ETSI Standard [EN 301 908-13 v6.2.1](http://www.etsi.org), available at www.etsi.org

A14.4 The 2.1GHz Band

In-block Power Limits

Base station power limits

A 14.17 The 2.1 GHz EC Decision sets out a non-obligatory in-block limit range between 61dBm/5MHz and 65dBm/5MHz in the FDD downlink band. An in-block power limit of 64dBm/5MHz is applicable to all base stations within the operator's assigned blocks. ComReg considers this limit to be sufficient for the provision of likely services in the band taking into account current base station deployment in 2.1 GHz Band.

Out-of-Block Power Limits

Baseline Power Limits

A 14.18 For frequencies spaced more than 10 MHz from the lower or upper block edge, a 9dBm /5MHz EIRP limit per antenna shall apply

Transitional Requirements

A 14.19 ComReg proposes the following transitional power limits:

- for -10 to -5 MHz offset from lower block edge or +5 MHz to +10 MHz offset from the upper block edge, a 11 dBm per antenna limit shall apply; and
- for -5 to 0 MHz offset from lower block edge or 0 to +5 MHz offset from the upper block edge, a 16.3 dBm per antenna limit shall apply.

Terminal Station BEM in-block power limit

A 14.20 The maximum mean-in-block power as for terminal stations emission limit over frequencies of FDD uplink shall be 24 dBm/5MHz.

A14.5 The 2.3 GHz Band

In-block Power Limits

Base Station Power limits

A 14.21 The 2.3 GHz ECC Decision sets out a non-obligatory in-block power limit. ComReg intends to implement an in-block limit at 68 dBm/5MHz given that

this limit is considered to be sufficient for the provision of likely services in the band. Additionally, ComReg proposes that all base stations would still be subject to baseline power limits, and transitional region power limits where applicable.

- A 14.22 A reduced in-block⁷⁵⁹ EIRP limit in the upper 10 MHz of the 2.3 GHz band (2390-2400 MHz) of not more than 45 dBm/5 MHz is required to ensure coexistence with systems above 2.4 GHz. These restricted blocks are identified in Figure 13 below.
- A 14.23 The Eir RurTel system currently occupies the frequency range 2307-2327 MHz (see Figure 13). Eir is currently engaged in a migration project to offload customers and reduce the size of this network. The impact of RurTel on the 2.3 GHz band is outlined in Chapter 5.

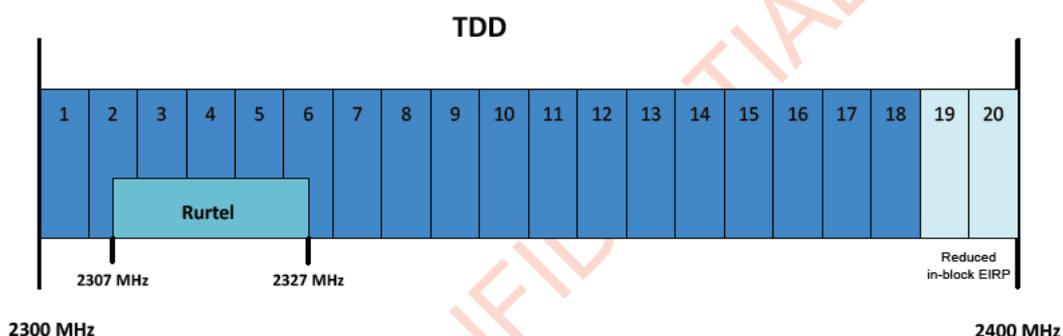


Figure 13: The 2.3 GHz Band (RurTel and Restricted Blocks)

Out-of-block Power Limits

Baseline requirements for TDD base station

- A 14.24 ComReg proposes that baseline power limits apply to synchronised and unsynchronised TDD blocks outside of in-block and transitional frequencies.
- A 14.25 ComReg sets out the two TDD baseline power limit values taken from the 2.3 GHz ECC Decision:

⁷⁵⁹ Block for which the BEM is derived.

- for synchronised TDD blocks a limit of $\text{Min}(\text{PMax}^{760} - 43, 13)$ dBm/5 MHz EIRP per antenna shall apply; and
- for unsynchronised TDD blocks -36 dBm/5 MHz EIRP per cell shall apply.

A 14.26 Additional baseline requirements are necessary above 2403 MHz for unsynchronised and synchronised MFCN base stations, these are:

- for $\text{Pmax} > 42$ dBm, power limit of 1dBm/5 MHz applies;
- for $24 \text{ dBm} < \text{Pmax} \leq 42$ dBm, power limit $(\text{Pmax} - 41)$ dBm / 5 MHz applies; and
- for $\text{Pmax} \leq 24$ dBm, a power limit of -17 dBm / 5 MHz applies.

Transitional region requirements for MFCN base stations

A 14.27 ComReg proposes the following transitional limits taken from the 2.3 GHz ECC Decision. These transition limits do not apply below 2300 MHz or above 2400 MHz.

A 14.28 The transitional limits proposed are, as follows:

- for - 5 to 0 MHz offset from lower block edge or 0 to 5 MHz offset from upper block edge a limit of $\text{Min}(\text{PMax} - 40, 21)$ dBm/5 MHz EIRP per antenna shall apply; and
- for - 10 to - 5 MHz offset from lower block edge or 5 to 10 MHz offset from upper block edge a limit of $\text{Min}(\text{PMax} - 43, 15)$ dBm/5 MHz EIRP per antenna shall apply.

Guard band emission limits

A 14.29 ComReg does not support the introduction of guard bands between assignments of TDD networks and so these limits would not apply.

Terminal station BEM in-block power limit

A 14.30 ComReg proposes a maximum in-block power limit for terminal stations of

⁷⁶⁰ Where PMax is the maximum mean power of the base station in question, measured as EIRP per carrier

25 dBm⁷⁶¹. The 2.3 GHz ECC Decision does allow for Member States to relax the limit under certain circumstances, particularly citing the example of fixed terminal stations.

A14.6 The 2.6 GHz Band

A 14.31 The 2.6 GHz EC Decision⁷⁶² sets out the technical conditions applicable to any new spectrum rights of use in the 2.6 GHz band. The proposed technical conditions for the 2.6 GHz band are in accordance with the EC Decision.

A 14.32 In the 2.6 GHz Primary Band Plan restricted blocks would be required where FDD and TDD spectrum blocks are adjacent to one another. The 2.6 GHz EC Decision sets out the in-block levels and BEM for the restricted blocks in the ranges 2570 – 2575 MHz and 2615 – 2620 MHz.

Unrestricted BEM for Base Stations

A 14.33 ComReg proposes that the BEM for an unrestricted spectrum block combining Baseline power limits, in-block power limits and transitional power limits are implemented in such a way that the limit for each frequency is given by the higher value.

In-block Power Limits

Base Station Power Limits

A 14.34 ComReg proposed that an in-block power limit be set at 61 dBm/5 MHz, given this limit is considered to be of a magnitude sufficient for the provision of likely services in the band. This in-block power limit would be applicable to all base stations assigned to an operator within the unrestricted blocks.

Coordination Threshold and Procedures

A 14.35 In light of the approaches taken in the benchmark countries and the analysis and recommendations of its technical advisors Plum, ComReg propose to implement mitigation measures recommended by Plum in its 2.6 GHz report

⁷⁶¹ This power limit is specified as EIRP for terminal stations designed to be fixed or installed and as total radiated power (TRP) for terminal stations designed to be mobile or nomadic. A tolerance of up to + 2 dB has been included in this limit, to reflect operation under extreme environmental conditions and production spread. Administrations may relax this limit in certain situations, for example fixed UE in rural areas, providing that protection of other services, networks and applications is not compromised and cross-border obligations are fulfilled.

⁷⁶² [2.6 GHz EC Decision](https://eur-lex.europa.eu/), available at <https://eur-lex.europa.eu/>

(Document 19/59c) to ensure coexistence between aeronautical radars operating in the 2.7 GHz band and new MFCN base stations in the 2.6 GHz band. This process is as detailed in Chapter 5 of this document.

Out-of-Block Power limits

Baseline Power Limits

A 14.36 The 2.6 GHz EC Decision defines baseline power limit values for frequencies allocated to FDD blocks and for those operating in TDD allocated blocks, ComReg would implement these limits as follows:

- for frequencies allocated to FDD downlink and ± 5 MHz outside the range of frequency blocks allocated to FDD down link (including SDL blocks), such as 2,615-2,620 MHz, a limit of +4 dBm/ MHz applies; and
- for frequencies in the 2.6 GHz band, not covered by above, a -45 dBm/MHz limit applies.

Transitional Power

A 14.37 The transitional power limits set out in the 2.6 GHz EC Decision are, as follows:

- for start of band (2500 MHz) to -5 MHz offset from lower block edge, or +5 MHz offset from upper block edge to end of band (2690 MHz), the baseline requirement level is applied;
- for -5 to -1 MHz offset from lower block edge or +1 to +5 MHz offset from upper block edge a limit of +4 dBm/MHz applies;
- for -1 to -0.2 MHz offset from lower block edge a limit of $+3+15(\Delta F+0.2)$ dBm/30 kHz applies⁷⁶³;
- for +0.2 to +1 MHz offset from upper block edge a limit of $+3-15(\Delta F-0.2)$ dBm/30 kHz applies; and
- for -0.2 to 0 MHz offset from lower block edge or 0 to + 0.2 MHz offset from upper block edge a limit of +3dBm/30 kHz applies;

⁷⁶³ Where: Δf is the frequency offset from the relevant block edge (in MHz)

Restricted BEM for Base Stations

The BEM for a restricted spectrum block is built up by combining the value from Baseline power (above) and in-block power limit (below) in such a way that the higher value gives the limit for each frequency.

In-block Power Limits

Base Station Power Limits

A 14.38 ComReg proposes a base station in-block power limit for restricted blocks not exceeding 25 dBm/5 MHz.

Out-of-Block Power limits

BEM for Base Stations with restrictions on antenna placement

A 14.39 Where antennas are placed indoors or where the antenna height is below a certain height, ComReg sets out alternative parameters in line with the Transitional Power Requirements described below. This is provided that at geographical borders to other member states the Baseline Requirements described above applies and that the above in-block power limits for restricted blocks remains valid nationwide.

Transitional Power Requirements

A 14.40 ComReg proposes that the base station out-of-block EIRP BEM for restricted block with additional restrictions on antenna placement:

- for start of band (2500 MHz) to -5 MHz offset from lower block edge, or +5 MHz offset from upper block edge to end of band (2690 MHz), a limit of -22 dBm/MHz applies;
- for -5 to -1 MHz offset from lower block edge or +1 to +5 MHz offset from upper block edge a limit of -18 dBm/MHz applies;
- for -1 to -0.2 MHz offset from lower block edge a limit of $-19+15(\Delta F+0.2)$ dBm/30 kHz applies⁷⁶⁴;
- for +0.2 to +1 MHz offset from upper block edge a limit of $-19-15(\Delta F-0.2)$ dBm/30 kHz applies; and

⁷⁶⁴ Where: Δf is the frequency offset from the relevant block edge (in MHz)

- for -0.2 to 0 MHz offset from lower block edge or 0 to + 0.2 MHz offset from upper block edge a limit of -19 dBm/30 kHz applies;

Terminal station BEM in-block power limit

A 14.41 ComReg proposes the maximum mean in-block power is defined as 31 dBm/5 MHz TRP, and 35 dBm/5 MHz EIRP, for terminal stations⁷⁶⁵.

A14.7 TDD inter-network synchronisation

A 14.42 ComReg proposes the following :

- Not setting guard bands between assignments. This means that unsynchronised networks require guard bands and that these guard bands are internalised within the block of spectrum assigned. As mentioned, by default, synchronised networks require no guard bands;
- Setting a TD-LTE frame configuration 2 (i.e. a downlink / uplink ratio of 3:1) or compatible frame structure as the default one for TDD networks; and
- As set out in the 2.6 GHz EC Decision, setting a permissive BEM for synchronised TDD networks and a restrictive BEM for unsynchronised networks

Special Sub-Frame

A 14.43 ComReg proposes that the special sub-frame 6 configuration be set as the default for TD-LTE networks in the 2.3 GHz and 2.6 GHz bands as outlined in Chapter 7.

Permissive and Restrictive BEMs

A 14.44 In respect of BEMs, ComReg proposes:

- Operators utilising frame structure configuration 2 on their network (and having a common reference phase clock with adjacent channel operators⁷⁶⁶) would be subject to a permissive BEM with the parameters set out in Table 24 and Table 25 below.

⁷⁶⁵ This limit includes Automatic Transmitter Power Control (ATPC) range.

⁷⁶⁶ Operators need to ensure the start of frame is aligned with adjacent channel operators above and below its assignment

Table 24: Permissive BEM for 2.3 GHz Band

BEM Element	Frequency Range	Power Limit
In-block	Block assigned to the operator	68 dBm/5 MHz
Transitional Region	-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	Min(PMax - 40,21) dBm/5 MHz EIRP per antenna
Transitional Region	-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	Min(PMax - 43,15) dBm/5 MHz EIRP per antenna
Baseline	2,300-2,390 MHz (except for in-block and transitional regions)	Min(PMax - 43,13) dBm/5 MHz

Table 25: Permissive BEM for 2.6 GHz Band

BEM Element	Frequency Range	Power Limit
In-block	block assigned to the operator 2575-2615 MHz	61 dBm/5 MHz
	Block assigned to the operator (2570-2575 MHz and 2615-2620 MHz)	25 dBm/5 MHz
Transitional Region	-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	Baseline requirement level is applied
Transitional Region	-1 to -5 MHz offset from lower block edge 1 to 5 MHz offset from upper block edge	+4 dBm/MHz
Transitional Region	-1 to -0.2 MHz offset from lower block edge	$3+15(\Delta F+0.2)$ dBm/30 kHz
Transitional Region	0.2 to 1 MHz offset from upper block edge	$+3-15(\Delta F-0.2)$ dBm/30 kHz
Transitional Region	-0.2 to 0 MHz offset from lower block edge 0 to 0.2 MHz offset from upper block edge	+3dBm/30 kHz
Baseline	2615-2620 MHz (except for in-block and transitional regions)	+4 dBm/ MHz

- Operators utilising alternative frame structures (or failing to synchronise with adjacent channel networks for any other reason) would be subject to the restrictive BEM with the parameters set in the Table 26 and Table 27 below. It is important to note that in order to meet the restrictive mask operators would likely have to adopt guard bands within its assignment.

Table 26: Restrictive BEM 2.3 GHz Band

BEM Element	Frequency Range	Power Limit
In-block	Block assigned to the operator in the range 2300-2390 MHz; and	68 dBm/5 MHz e.i.r.p. per antenna
	Block assigned to the operator in the range 2390-2400 MHz	shall not exceed 45 dBm/5 MHz to ensure coexistence with systems above 2,400 MHz
Baseline	2300-2400 MHz (except for in-block frequencies)	-36 dBm/5 MHz EIRP per cell ⁷⁶⁷

Table 27: Restrictive BEM 2.6 GHz Band

BEM Element	Frequency Range	Power Limit
In-block	Block assigned to the operator (2570-2575 MHz and 2615-2620 MHz)	25 dBm/5 MHz
	Block assigned to the operator 2,575-2,615 MHz	61 dBm/5 MHz
Baseline	2570-2575 MHz (except in UL mode operation in that block) and any 5 MHz block between unsynchronized TDD networks (2575-2620 MHz)	-45 dBm/MHz EIRP (integrated over 1 MHz bandwidth) (-38 dBm/5MHz)

A 14.45 ComReg proposes to exempt small cells (with an EIRP not exceeding 24 dBm) for indoor domestic and other indoor locations from synchronisation restrictions.

⁷⁶⁷ This value is based on a scenario including all base station classes (Macro, Micro, Pico and Femto). A more restrictive scenario may allow a more relaxed value for some BS classes

Annex: 15 Other matters raised

A 15.1 In replying to Document 19/59R, respondents raised some other matters which were beyond the intended scope of that document. This annex sets out ComReg's assessment of these matters.

A15.1 Use of term 'MNO' with liberalised spectrum

A 15.2 While recognising that the use of the term MNO in Document 19/59R was appropriate in certain contexts, Imagine submitted that its use throughout the document (as an apparent proxy term for a licenced spectrum operator) was unhelpful when discussing liberalised spectrum.

ComReg's assessment

A 15.3 The term MNO is used extensively in Document 19/59R and also in this document. This does not mean that spectrum in the Proposed Bands can only be used for mobile purposes, but that the mobile market, and the operators (MNOs) in that market, are a significant consideration in relation to the award proposals for the Proposed Bands.

A 15.4 Where appropriate, ComReg also considers operators other than the MNOs. For example, ComReg's consideration of the:

- overall competition spectrum cap is informed by the possibility that operators other than the MNOs (i.e. FWA operators or small cell operators) may win spectrum rights in the Proposed Award; and
- the geographic extent of licences (e.g. national, regional, etc.) is informed by Imagine's response to Document 19/59R, where it put forward views based on being a FWA operator.

A 15.5 For the avoidance of doubt, ComReg:

- envisages that the likely uses for the spectrum rights of use proposed to be assigned in the Proposed Award are FWA and mobile – no respondent has indicated another potential use but ComReg does not rule out any other potential use;
- it has carefully considered the interests of potential licensees in both the mobile and FWA spaces;
- it has carefully considered all responses to its consultation documents;

- nothing in its consultation documents indicates a bias towards any potential use of spectrum over any other and the frequency with which references are made to MNOs is driven by, amongst other things, the number of submissions made by, or relating to, MNOs and the more detailed conditions that are proposed to apply to MNO usage; and
- nothing in the Proposed Award Process itself will discriminate between potential uses of spectrum, although, different conditions may apply as regards different uses.

A15.2 Spectrum for local/ private broadband uses

A 15.6 Motorola is of the view that ComReg, as part of its new spectrum management plan, should consider whether there is an opportunity to assign spectrum in the 3.6 GHz band and the 3.8 - 4.2 GHz frequency range for local and private broadband uses based on LTE/NR systems.

A 15.7 Motorola observes that a number of countries⁷⁶⁸ have already made provisions for local and private broadband uses, and it states that its own investigations suggest that some infrastructure and chip manufacturers already accommodate the 3.8 - 4.2 GHz range in their 5G product roadmap.

ComReg's assessment

A 15.8 ComReg notes Motorola's views and the information submitted in support of considering local and private broadband uses.

A 15.9 ComReg observes that this can be served in a number of different ways. Some methods (e.g. use of licensed or licensed-exempt spectrum) may require specific spectrum management provisions as suggested by Motorola, while other methods would not require specific spectrum provisions. For example, Vodafone Group has indicated that such services could be purchased from a licensed operator or that the private operator could lease spectrum from a licensed operator.⁷⁶⁹

A 15.10 Should stakeholders believe that spectrum for local and private broadband use be a topic relevant to the Irish market, ComReg observes that respondents to ComReg's consultations will have an opportunity to raise this topic in response to relevant ComReg publications, such as ComReg's forthcoming study of the 26 GHz band in relation to 5G (envisaged for

⁷⁶⁸ Germany (3.7-3.8 GHz), Sweden (3.7-3.8 GHz), France (part of the 2.6 GHz band), US regulatory principle of CBRS ("Citizens Broadband Radio Services"), which operates in 3GPP Band 48 (3.55 – 3.7 GHz), and the UK (3.8-4.2 GHz in addition to smaller blocks in the 1.8 GHz Band and the 2.3 GHz Band).

⁷⁶⁹ See for example, Vodafone's "[An Industrial 5G Spectrum Policy for Europe](#)" November 2019.

publication in Q2 2020), or ComReg's consultation on its next spectrum management strategy.

A15.3 Consideration of Irish consumers' views

A 15.11 Noting the importance of the issues being considered in Document 19/59R and the detailed technical content necessary to explain such matters, Mr Young submitted that ComReg's consultation may be less accessible for non-industry stakeholders and ComReg may be under-exposed to the views of Irish consumers.

A 15.12 Mr. Young suggested that ComReg should seek the views of consumers, and he recommended that ComReg consider the possibility of adopting more accessible mechanisms to consult more widely with non-professional and non-industry stakeholders in relation to this matter.

ComReg's assessment

A 15.13 ComReg agrees that many of the matters discussed in this document are important for consumers as evident from ComReg's consideration of consumers' views in relation to award proposals throughout this document.

A 15.14 However, as part of a process such as this, many detailed technical and economic issues need to be considered,⁷⁷⁰ which are unlikely to be of interest to consumers. Accordingly, consumers are unlikely to be willing to invest the time necessary to respond to a consultation of this nature. That said, submissions from Consumers are of course welcome.

A 15.15 ComReg further observes that:

- It seeks views from consumers via different mechanisms, including:
 - surveys on the mobile consumer experience,⁷⁷¹ which, for instance evaluated consumer willingness to pay for enhanced coverage;

⁷⁷⁰ As acknowledged by Mr Young: "To put this simply, the detailed technical and economic issues, and the complex nature of the considerations and technical jargon that are inherent in this process, and as set out by Comreg and its consultant reports, are not likely to be easily understood by the average citizen or mobile user, and will very likely discourage many from responding to Comreg's consultation invitation. (emphasis added), Mr Young's submission at page 7.

⁷⁷¹ See ComReg Document [19/101](#), "Mobile Consumer Experience survey 2019", published 18 November 2019, and ComReg Document [17/100a](#), "Mobile Consumer Experience survey" published 6 December 2017.

- complaint/query statistics from ComReg's consumer line reports;⁷⁷² and
- ComReg's Consumer Advisory Panel, which provides engagement with key consumer representative organisations.
- ComReg's award proposals have regard to its statutory functions, objectives and duties. Two of its statutory objectives are to (i) promote competition and (ii) promote the interests of users within the Community.
- Eight draft Regulatory Impact Assessment (RIAs)⁷⁷³ are set out in this document covering matters such as the proposed coverage and rollout obligations for the Proposed Bands, quality of service and network availability, and indoor mobile voice and text connectivity. As explained in Annex 6, the impact of the various options on industry, consumers and competition is explicitly considered in each of these draft RIAs.

A 15.16 Noting the above, and while thanking Mr. Young for his views, ComReg is of the view that appropriate consideration is being given to the views of consumers in relation to the matters discussed in this document. Moreover, ComReg believes that the interests of consumers would be unlikely to be furthered by delaying the release of rights of use of spectrum to embark on further detailed consultation with consumers.

⁷⁷² See for example ComReg Document [19/97](#), "ComReg Consumer Line Statistics Q3 2019", published 31 October 2019, and similar ComReg Consumer Line Statistics reports published earlier.

⁷⁷³ In considering processes that might result in the imposition of a regulatory obligation (or the amendment of an existing obligation) or which might otherwise significantly impact on any relevant market or on any stakeholders or consumers, ComReg will generally conduct a Regulatory Impact Assessment (RIA) to assess the various regulatory options.