An Coimisiún um
Rialáil Cumarsáide
Commission for
Communications Regulation

Response to Consultation and Decision on the 400 MHz Band Spectrum Award

Response to Consultation and Decision

Reference: ComReg 19/69

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Overview of Key Proposals

1 ComReg is the manager of the radio spectrum in Ireland, over which all wireless communications such as mobile phones, radars, radios, televisions and various connected devices take place. This particular document sets out ComReg's final decisions and addresses responses received to ComReg Document 19/23 in relation to assigning rights of use for the non-harmonised spectrum sub-band in the 410 – 414 MHz / 420 – 424 MHz range ("the 400 MHz Band").

2 ComReg has decided to award this spectrum via two sequential Simple Clock Auctions ("SCA") with exit bids and combinatorial closing rules, where the spectrum will be made available as follows:

- 410 – 413 MHz / 420 – 423 MHz ("Part A") will be made available to Network Utility Operators for the provision of wireless connectivity for Smart Grid[1]; and
- 413 – 414 MHz / 423 – 424 MHz ("Part B") will be made available to any interested party on a service and technology neutral basis.

Should Part A go unsold, ComReg will include this spectrum in the Part B award process.

3 ComReg notes that Smart Grids are a key component of government efforts to meet the demand for energy in a cost effective and secure way while also reducing the environmental impact (including carbon emissions)[2]. A Smart Grid, using new technology, could result in substantial reductions in energy use and carbon emissions and could make renewable energy and efficiency programs more affordable and accessible.

[1] "Smart Grid" means advanced delivery systems for utility services (electricity, gas and water) from sources of generation and production to key elements in the grid networks and includes all supervisory and control necessary for their effective management. For the avoidance of doubt, this definition does not include the use of smart metering, which consists of devices located at premises that record energy, water and gas usage and provide two-way electronic communication between consumers and the grid.
[2] Transition to a Low Carbon and Climate Resilient Society – National Strategic Outcome 8 of the National Development Plan 2018 – 2027. https://www.gov.ie/pdf/?file=https://s3-eu-west-1.amazonaws.com/govieassets/831/130718120306-5569359-NDP%20strategy%202018-2027_WEB.pdf#page=76

4 ComReg considers that the Simple Clock Auction ("SCA") is an appropriate auction format for this award process as it provides sufficient protection against an inefficient outcome while also being less complex than alternative combinatorial awards, providing a straightforward process for less experienced bidders that may participate in this award.

5 ComReg's final decision is to maintain its minimum price proposals as follows, noting that final prices will ultimately be determined by the bidders in the SCA and not ComReg:

- for Part A, there will be a minimum price of €590,000[3]. This comprises an upfront minimum SAF of €240,000 and an annual SUF of €39,000 subject to annual indexation by CPI; and
- for Part B, there will be a minimum price of €19,600[4] for a 2 × 100 kHz lot. This comprises an upfront minimum SAF of €8,000 per 2 × 100 kHz lot and an annual SUF of €1,300 per lot subject to annual indexation by CPI.

6 ComReg has decided that a 15 year licence duration is appropriate as it allows for the re-use of the spectrum for other possible purposes within a reasonable time frame, while ensuring that licensees are not locked into using spectrum for longer than is necessary given future technology changes.

7 The mode of operation will be Frequency Division Duplex (FDD)[5] as this aligns with ECC Decisions (16)02 as amended[6] and (19)02[7], and eliminates the possibility of interference between any future user of BB-PPDR and 400 MHz Band licensees.

[3] Discounted at a rate of 8.63%.
[4] Discounted at a rate of 8.63%.
[5] Frequency-division duplexing (FDD) is a method for establishing a full-duplex communications link that uses two different radio frequencies for transmitter and receiver operation. FDD operation normally assigns the transmitter and receiver to different communication channels. One frequency is used to communicate in one direction, and the other frequency is required to communicate in the opposite direction. The transmit direction and receive direction frequencies are separated by a defined frequency offset.
[6] ECC Decision of 17 June 2016 on harmonised technical conditions and frequency bands for the implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems, amended 8 March 2019
[7] ECC Decision of 8 March 2019 on Land mobile systems in the frequency ranges 68-87.5 MHz, 146-174 MHz, 406.1-410 MHz, 410-430 MHz, 440-450 MHz and 450-470 MHz

8 Any potential 400 MHz Band licensee must adhere to the technical conditions outlined in this Decision, including the Block Edge Masks as outlined in Annex 2 of this document, and that a 50 W EIRP limit will apply. To take account of footnote 5.149 of the Radio Regulations[8] and ITU Recommendation RA. 769-2[9], ComReg has also decided that any 400 MHz Band licensee must coordinate with Radio Astronomy users so as to minimise harmful interference.

9 ComReg has set the following coverage obligations:

- where the 400 MHz Band is being used for the provision of Smart Grid, a licensee must provide wireless communications to 50% of its utility network by the seventh anniversary of the commencement of the licence; and

- where the 400 MHz Band is not being used for Smart Grid, licensees must achieve and maintain 10 base stations in each of the defined areas in Section 2.9 of this document by the third anniversary of the commencement date of the licence.

10 ComReg has also set out reporting requirements so that it can monitor and ensure the above rollout obligations are met. Annual compliance reports are to be submitted to ComReg on each anniversary of the commencement date of the licence and, on the relevant anniversary of the commencement date as set out in paragraph 8 above, ComReg will assess whether or not the licensee(s) have complied with the obligation.

11 Separately, many European countries are now considering upgrading or replacing their incumbent public safety networks with new Broadband Public Protection and Disaster Relief ("BB-PPDR") networks which aim to integrate a broadband capability into a secure, resilient and high availability network. ComReg has made provision for the delivery of BB-PPDR in the spectrum range 414 – 417 MHz / 424 – 427 MHz. drawing on the recommendations of its consultants, LS Telcom Ltd (LS Telcom).

[8] https://life.itu.int/radioclub/rr/arsfoot.htm footnote 5.149.
[9] https://www.itu.int/dms_pubrec/itu-r/rec/ra/R-REC-RA.769-2-200305-I!!PDF-E.pdf

12 The LS Telcom report, published by ComReg on 18 June 2019 as Document 19/59e[10] (the LS Telcom BB-PPDR Study) takes into account, among other things, the harmonised spectrum options set out in the EC 700 MHz Decision[11] and ECC Decision (16)02 as amended. The LS Telcom BB-PPDR Study outlines the various network deployment options and spectrum requirements for any future deployment of BB-PPDR of which this provision now forms part.

Next Steps

13 Following public consultation of the draft Information Memorandum, Document 19/56, ComReg will, in due course, publish a response to draft Information Memorandum and a final Information Memorandum, and in doing so initiate the award process. The precise date of publication of the final Information Memorandum is subject to ComReg obtaining the consent of the Minister to the making by ComReg of the Wireless Telegraphy (400 MHz Band Licences) Regulations 2019.

[10] See www.comreg.ie
[11] Commission Implementing Decision (EU) 2016/687 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 EU.

Chapter 1

1 Introduction

1.1 In March 2019, the Commission for Communications Regulation ("ComReg"), in Document 19/23, published its Response to Consultation 18/92 and a draft Decision on the future award of the 410 – 414 MHz / 420 – 424 MHz band ("the 400 MHz Band").

1.2 Three interested parties responded to Consultation 19/23[12] (non-confidential versions of which are published alongside this paper – ComReg Document 19/69s):

- Electricity Supply Board Networks Limited ("ESBN");
- European Utilities Telecom Council ("EUTC"); and
- Joint Radio Company Limited ("JRC").

1.3 The purpose of this document is to set out ComReg's response to those submissions and set out its final decisions concerning its proposed award of a limited number of individual rights of use in the 400 MHz Band.

1.4 ComReg is publishing alongside this response to consultation and decision:

- Document 19/69a – An analysis prepared by ComReg's economic and award design expert DotEcon Limited ("DotEcon") of the submissions received in response to Document 19/23 relating to the award design and fee structure; and
- Document 19/69s – Submissions to ComReg Document 19/23.

1.5 ComReg, in preparing this response to consultation and all associated documents and in arriving at its final decisions as set out herein has had regard to:

- its statutory functions, objectives and duties relevant to its management of the radio frequency spectrum (summarised in Annex 1);
- all submissions received from interested parties through public consultation and all other relevant information before it; and
- the independent expert advice and recommendations of DotEcon and the advice of Plum Consulting LLP ("Plum")[13].

[12] ComReg Document 19/69s – Submissions to ComReg Document 19/23 – Published alongside this document.
[13] ComReg Document 19/23a – Plum Consulting Assessment of Responses Received to Document 18/92 – Published 15 March 2019.

1.6 All matters concerning the award process which ComReg has now decided to implement and conduct, as contained and considered in previous consultation documents, should be regarded as having been considered in full in the preparation of this Response to Consultation and associated documents and in arriving at the final decisions set out herein.

1.7 Capitalised terms in this document not otherwise defined shall have the meaning as ascribed to them in ComReg Document 19/56[14].

1.8 This document is structured as follows:

- **Chapter 2** sets out ComReg's response to issues raised by respondents to Document 19/23;
- **Chapter 3** sets out ComReg's final Regulatory Impact Assessment;
- **Chapter 4** contains the Decision Instrument;
- **Chapter 5** sets out the next steps in the process;
- **Annex 1** contains the Legal Basis;
- **Annex 2** contains the Block Edge Mask; and
- **Annex 3** contains the 450 – 470 MHz band overview.

[14] ComReg Document 19/56 – Proposed 400 MHz Band Spectrum Award – Draft Information Memorandum and Draft Regulations – Published 12 June 2019.

Chapter 2

2 Response to Submissions Received to Document 19/23

2.1 Introduction

2.1 This chapter sets out ComReg's final positions on issues raised by respondents in response to ComReg Document 19/23.

2.2 Part B Spectrum

Summary of ComReg's view in Document 19/23

2.2 In Chapter 2 of Document 19/23, ComReg noted that responses received to Consultation 18/92 indicated a demand for 2 × 3 MHz of 400 MHz spectrum for the provision of Smart Grid.

2.3 ComReg also noted a number of international developments regarding Broadband Public Protection and Disaster Relief ("BB-PPDR") including:

- the importance of BB-PPDR as outlined by the International Telecommunications Union ("ITU"), the Law Enforcement Work Party ("LEWP")[15], and the European Communications Committee ("ECC"); the updated ECC Decision (16)02[16] which includes provision to harmonise the use of BB-PPDR in parts of the 700 MHz band, the 450 – 470 MHz band and the 410 – 430 MHz band;
- that the 450 – 470 MHz range is currently allocated to and extensively used by Private Mobile Radio ("PMR") and other similar services, and is thus unsuitable for deployment of wideband type applications such as Smart Grid and BB-PPDR; and
- the likely availability of BB-PPDR equipment in the 400 MHz Band through the work of the ECC, ETSI[17] and a 3GPP[18] standardisation work item. ComReg also noted that in their submissions to ComReg Document

[15] Radio Communications Expert Group of the Law Enforcement Working Party which is officially reporting to JHA (Justice & Home Affairs) within the Council of the European Union.
[16] ECC Decision (16)02 - Harmonised technical conditions and frequency bands for the implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems.
[17] The European Telecommunications Standards Institute (ETSI), produces globally-applicable standards for Information and Communications Technologies, including fixed, mobile, radio, converged, broadcast and internet technologies. ETSI are officially recognised by the European Union as a European Standards
Organization.
[18] https://portal.3gpp.org/ngppapp/TdocList.aspx?meetingId=18670

18/92, Huawei and Nokia states that BB-PPDR equipment is currently available for the 400 MHz Band.

2.4 Having considered the above points, ComReg proposed to make 2 × 3 MHz available for the provision of BB-PPDR from 414 – 417 MHz / 424 – 427 MHz. This proposal reduced the available spectrum in Part B for this Award Process from 410 – 415.5 MHz / 420 – 425.5 MHz to 410 – 414 MHz / 420 – 424 MHz. ComReg noted that the proposal did not decrease the quantum of spectrum in Part A (2 × 3 MHz from 410 – 413 MHz / 420 – 423 MHz) for the provision of Smart Grid as identified in Consultation 18/92.

Views of Respondents

2.5 ComReg received 3 responses on the proposed reduction of Part B spectrum.

2.6 JRC submits that, in its view, it is late to intervene in the regulatory process with a proposal that it sees as potentially detrimental to the facilitation of Smart Grid in this band. JRC contends that the proposal:

- prevents a bidder from accessing up to 2 × 5 MHz of spectrum for Smart Grid use and as a result reduces flexibility in terms of the number of sites and quantity of equipment that will need to be deployed, increasing equipment cost and complexity; and
- is at odds with the emphasis being placed across Europe on the 700 MHz band for BB-PPDR.

2.7 The EUTC submits that:

- PPDR already has alternative access to 2 × 5 MHz of spectrum in the 380 – 400 MHz range with ambitions to gain access to the 700 MHz range also; and
- that utilities should be allowed to focus on the 410 – 430 MHz range in Ireland with access for PPDR to the 380 – 400 MHz range for wide-area use and the 700 MHz for more urban areas.

2.8 ESBN expresses disappointment that ComReg has introduced a new proposal into the proposed 400 MHz spectrum award at draft Decision stage. ESBN contends that the proposal precludes a Network Utility Operator from deploying a 2 × 5 MHz LTE Smart Grid network, putting a limit on the capabilities of such a network and places an upper limit on the number of devices that can connect to such a network. This in turn makes the business case for Smart Grid more difficult.

2.9 ESBN further states that ECC Decision (16)02 does not place any requirement on regulators to make spectrum in the 400 MHz band available for BB-PPDR, but rather that the ECC proposes that spectrum in the 700 MHz band primarily be made available for BB-PPDR with the possibility to release additional

spectrum in the 410 MHz or 450 MHz ranges only if required. ESBN contends that this proposal gives no long term potential for Smart Grid to have access to spectrum other than 3 MHz LTE channels, where BB-PPDR is getting one if not two additional bands for expansion.

2.10 ESBN is of the view that the 700 MHz band is more suitable for BB-PPDR, and should additional spectrum be required then ComReg should consider the existing 380 – 400 MHz spectrum band to supplement any potential 700 MHz allocation.

2.11 ESBN requests ComReg to confirm its plans with regards to the 700 MHz band and in so doing to make some of the 700 MHz spectrum available for BB-PPDR. ESBN would like ComReg to provide more details on the future allocation of spectrum for BB-PPDR. ESBN asks ComReg to consider PPDR in a regulatory impact assessment ("RIA"), arguing that it is not efficient use of spectrum to leave it fallow for a long time waiting for a potential user where there is apparent demand and a requirement for usage from alternative spectrum users.

2.12 ESBN concludes that ComReg should make 2 × 7 MHz of spectrum available in this band, and suggests a range of potential deployment options including:

- 2 × 5 MHz available for Smart Grid and the remaining 2 × 2 MHz available for other users; or
- maintain 2 × 3 MHz for Smart Grid deployment and auction the remainder; or
- make 2 × 7 MHz available for the provision of Smart Grid, and should BB-PPDR require services in the future, a Smart Grid operator may be obliged to provide fair and reasonable access.

2.13 Finally, ESBN asks ComReg to provide clarity on whether BB-PPDR would effectively have access to 3 spectrum bands (380 – 400 MHz, 410 MHz and 700 MHz) and if so, what is the rationale for same.

ComReg's Assessment and Final Position

2.14 In Documents 18/92 and 19/23, ComReg provided a detailed analysis of the requirements of Smart Grid and its spectrum requirements. This analysis is set out in the Final RIA below.

2.15 ComReg concluded that 2 × 3 MHz of spectrum is required for the provision of Smart Grid in order to provide for mission critical applications[19]. This was based on a number of factors including:

- the advice of its expert technical advisors Plum who came to the conclusion that 2 × 3 MHz is required for the provision of Smart Grid;

[19] Other non-mission critical applications have other spectrum and deployment options available.

- the European Telecommunications Standards Institute ("ETSI")[20] who recommend that 2 × 3 MHz of spectrum be made available for the provision of Smart Grid, and states that an allocation of 2 × 3 MHz would satisfy narrowband, wideband and broadband requirements of Smart Grid[21]; and
- responses to ComReg consultations on the release of the 400 MHz Band, where respondents agreed with ComReg's assessment of the requirement for 2 × 3 MHz.

2.16 Furthermore ComReg notes statements by ESBN and EUTC in support of ComReg's proposal to allocate 2 × 3 MHz of spectrum for Smart Grid including ESBN's statement in response to ComReg Document 18/92 that, "*ComReg is correct in taking the advice from ETSI, EUTC, JRC, ESBN and CEPT FM54 that 2 × 3 MHz of spectrum is the minimum amount of spectrum required for Smart Grid*"[22].

2.17 ComReg also notes the EUTC spectrum position paper[23] in which the EUTC states that there is a need for a 2 × 3 MHz contiguous block of spectrum, and also the EUTC response to the RSPG Opinion on 5G implementation challenges, wherein the EUTC states that it is "*seeking a harmonised tuning range for 2 × 3 MHz of dedicated utilities spectrum across Europe in the 400 MHz region*" for Smart Grid[24].

2.18 Given the above, and ComReg's overall assessment in the Final RIA, ComReg remains of the view that 2 × 3 MHz is sufficient for the provision of Smart Grid. ComReg also maintains its view that making provision of 2 × 3 MHz (from 414 – 417 MHz / 424 – 427 MHz) for BB-PPDR should not prevent a Network Utility Operator from deploying a Smart Grid network.

2.19 With regard to suggestions that the 380 – 400 MHz range could be allocated for BB-PPDR, ComReg notes that this band is currently used for narrowband digital PPDR radio applications using channel bandwidth up to 25 kHz (i.e. mission critical voice applications) in line with ECC Decision (08)05[25]. ComReg also notes that ECC Decision (16)02 harmonises the 410 – 430 MHz range for BB-PPDR to address specified requirements not covered by ECC Decision (08)05

[20] The European Telecommunications Standards Institute (ETSI), produces globally-applicable standards for Information and Communications Technologies, including fixed, mobile, radio, converged, broadcast and internet technologies. ETSI are officially recognised by the European Union as a European Standards Organization.
[21] ETSI TR 103 492 V1.1.1 (2019-01).
[22] ComReg Document 19/23s - Response to Consultation on the Proposed Release of the 400 MHz Band - Non-Confidential Submissions to Document 18/92 – published 15 March 2019.
[23] https://eutc.org/wp-content/uploads/2018/08/EUTC-Spectrum-Position-Paper.pdf
[24] https://eutc.org/wp-content/uploads/2019/04/EUTC-Response-RSPG_3rd_opinion_on_5G.pdf
[25] https://www.ecodocdb.dk/download/5e4038fd-41f1/ECCDEC0805.PDF

such as coverage, and support of broadband applications like video streaming, resilience, security etc.

2.20 In relation to PPDR, ComReg has undertaken a number of actions to provide clarity on the future use of PPDR and any potential spectrum requirements. In particular, ComReg:

- commissioned LS Telcom Ltd (LS Telcom) to carry out a study on the various network deployment options and spectrum requirements for any future deployment of BB-PPDR in Ireland. The findings of this study are set out in the LS Telcom BB-PPDR Study (ComReg Document 19/59e)[26]; and
- set out its draft spectrum management assessment on the amount of spectrum in the 700 MHz duplex that should be included in the proposed MBSA award in Annex 3 of Document 19/59[27].

2.21 In Document 19/59e, LS Telcom presents the results of research and analysis into a variety of network and spectrum options for the provision of BB-PPDR services, and sets out the most viable options for Ireland. In summary, it noted that:

- dedicated spectrum may be needed to support PPDR, including the main 700 MHz band, 3GPP Band 28B (2 × 3 MHz) in the 700 MHz band, 3GPP Band 68 (2 × 5 MHz) in the 700 MHz band, the 410 – 430 MHz band and the 450 – 470 MHz band[28];
- while the majority of European countries are considering how commercial networks can form part of the BB-PPDR solution, most countries are also considering dedicated spectrum to support BB-PPDR[29];
- ComReg's proposal to make 2 × 3 MHz available for BB-PPDR brings the 410 – 430 MHz band into consideration for the deployment of future BB-PPDR services[30] and this would not affect the allocation of 2 × 3 MHz proposed for Smart Grid[31]; and

[26] ComReg Document 19/59e – LS Telcom Report – Study on Terrestrial BB-PPDR Spectrum Options - Published 18 June 2019.
[27] ComReg Document 19/59 – Proposed Multi Band Spectrum Award - Including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands, – Published June 18 2019.
[28] ComReg Document 19/59e – Section 2.3.
[29] ComReg Document 19/59e – Section 3.3.16.
[30] ComReg Document 19/59e – Section 4.3.
[31] ComReg Document 19/59e – Section 5.3.

- the 410 – 430 MHz band and the 700 MHz band option 2 (i.e. 2 × 3 MHz in 3GPP Band 28B), and to some extent 700 MHz band option 1 (i.e. 2 × 5 MHz in 3GPP Band 68) are the technically viable spectrum options with the most potential for BB-PPDR in Ireland[32].

2.22 Document 19/59[33] sets out ComReg's preliminary views on the spectrum management considerations for BB-PPDR, which are summarised as follows:

- the proposal to progress the proposed Multi-Band Spectrum Award on the basis of including the full 2 × 30 MHz of the 700 MHz duplex as this would be the most appropriate option in terms of ComReg's spectrum management function and objectives;
- the proposal to make available 2 × 3 MHz of spectrum in the 410 – 430 MHz band for BB-PPDR is a significant step towards meetings Ireland's BB-PPDR spectrum requirements estimate of 2 × 6 MHz;
    - the propagation characteristics of which are very comparable to that used by the existing TETRA networks and as such is suitable for the effective deployment of wide area coverage which could be achieved using existing sites; and
    - Nordic Telecom, along with Nokia[34], is developing an LTE network for critical communications in the Czech Republic using 400 MHz spectrum.
- spectrum in the 700 MHz duplex gap and 700 MHz guard bands (i.e. Band 68 (2 × 5 MHz) and Band 28B (2 × 3 MHz)) could also be made available for BB-PPDR use if required, in line with the flexibility afforded to the State in respect of same under the EC 700 MHz Decision[35].

2.23 In light of the above, ComReg's final position is that 2 × 4 MHz from 410 – 414 MHz / 420 – 424 MHz should be made available for the proposed award where:

- 2 × 3 MHz from 410 – 413 MHz / 420 – 423 MHz will be allocated for the provision of wireless connectivity for Smart Grid ("Part A"); and
- the remaining 2 × 1 MHz from 413 – 414 MHz / 423 – 424 MHz will be made available on a service and technology neutral basis ("Part B").

[32] ComReg Document 19/59e – Section 4.6.
[33] Proposed Multi Band Spectrum Award - Including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands, Document 19/59 – Published June 18 2019 – Section 2.3 and Annex 3.
[34] 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/
[35] EC Decision (EU) 2016/687 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.

2.3 Award format and structure

Summary of ComReg's view in Document 19/23

2.24 In Document 19/23, ComReg was of the preliminary view that:

- the preferred award format for Part A and Part B was a Simple Clock Auction ("SCA") with exit bids and a combinatorial closing rule;
- the award would comprise of two sequential parts:
  - the first part would allow qualified bidders (that is, Network Utility Operators) to bid for a single frequency specific Part A lot (2 × 3 MHz); and
  - the second part would allow all bidders (including Network Utility Operators) to bid for the remaining frequency generic Part B spectrum. Should Part A go unsold in the first auction, all of the available spectrum would be made available on a frequency generic basis for the second auction.
- a follow up assignment stage would assign specific frequencies to each winner of Part B lots using a random assignment process; and
- a competition cap was unnecessary.

Views of Respondents

2.25 ESBN submits that, without prejudice to its preferred position of administrative assignment, it agrees that an auction provides an objective, transparent and non-discriminatory means of issuing spectrum. Absent an administrative assignment, ESBN agrees with ComReg's proposal to release this spectrum via auction.

2.26 ESBN agrees with ComReg's proposal to conduct the award in two parts (Part A and Part B), stating that this facilitates the base requirements of a Smart Grid operator whilst providing flexibility for a Smart Grid operator and any other interested users to compete for the remaining spectrum.

2.27 ESBN agrees that:

- there is no requirement for a competition cap,
- the proposed packaging of spectrum is suitable for this award; and
- a random assignment process for Part B lots should be used as there is no material value difference between spectrum locations in the band.

ComReg's Assessment and Final Position

2.28 ComReg notes the general support of ESBN for ComReg's proposals on award format and structure. Regarding ESBN's preferred assignment method of an administrative assignment, ComReg has addressed this issue in previous 400 MHz consultation documents and in particular Section 4.2 of Document 18/92.

2.29 In light of the above, ComReg's final position is:

- the award format for Part A and Part B will be a SCA with exit bids and combinatorial closing rule;
- the award will comprise of two sequential parts, potentially requiring an auction in either part:
  - the first part will allow qualified bidders (that is, Network Utility Operators) to bid for a single frequency specific Part A lot (2 × 3 MHz); and
  - the second part will allow all eligible bidders (including Network Utility Operators) to bid for the remaining frequency generic Part B spectrum. Should Part A go unsold in the first auction, all of the available spectrum will be made available on a frequency generic basis for the second auction.
- to use a follow up assignment stage will assign specific frequencies to each winner of Part B lots using a random assignment process; and
- that a competition cap will not be used.

2.4 Pricing mechanism

2.30 In Chapter 4 of Document 19/23, ComReg expressed the preliminary view that Part A and Part B spectrum would be awarded sequentially using (where necessary) the Simple Clock Auction ("SCA") format, with exit bids and a combinatorial closing rule.

2.31 ComReg was also of the preliminary view that a SCA and the associated 'pay as bid' pricing mechanism was appropriate for the proposed award process for a number of reasons, including:

- the proposed pay as bid mechanism in the SCA format should result in final prices that are in line with opportunity cost pricing, as bidders only need to bid just enough to outbid other bidders[36]; and

[36] This is because bidders bid for the item in successive rounds until the round price exceeds the second highest bidder's valuation, at which point the auction ends. The winner then pays the prevailing round price (or its exit bid). The closer the winning bid is to the second highest bidder's valuation, the closer it approximates opportunity cost.

- opportunity cost pricing is unlikely to make a material difference to the price paid, and would introduce complexity which is unlikely to be justified by the potential benefits.

2.32 ComReg also noted that any efficiency gains were unlikely to be sufficient to justify their use for an award where the benefits of straightforward rules for bidders is likely to be important.

Views of Respondents

2.33 ESBN favours the use of opportunity cost pricing instead of the proposed "pay-as-bid" pricing mechanism as, in its view:

- any complexity with opportunity cost pricing is burdened by the auctioneer rather than the participants and would not add significant complexity; and
- opportunity cost pricing is possible when the auction finishes in a round when supply is equal to, or is greater than demand, and any money paid above what is required for an efficient outcome would have been invested in rolling out a network.

ComReg's Assessment and Final Position

2.34 ComReg assesses the views of ESBN by reference to (i) complexity and (ii) investment incentives.

Complexity

2.35 DotEcon notes in Document 19/69a[37] that all views previously set out by it in Document 19/23b continue to apply, and that it does not recommend making any changes to the pricing rules previously proposed for this award.

2.36 In relation to complexity, DotEcon notes that implementing opportunity cost pricing would not be particularly onerous, however, there are good arguments for keeping the auction rules as simple as possible:

- First, it is not correct to claim that complexity resides solely with the auctioneer; bidders also need to have a good understanding of the pricing rules, and pay-your-bid[38] is conceptually simpler than opportunity cost pricing. In particular, there are good arguments for keeping the auction rules as simple as possible for bidders (given the likely participation from bidders with little or no previous experience of spectrum auctions).

[37] ComReg Document 19/69a – DotEcon Assessment of Responses to Document 19/23 – Published June 2019.
[38] ComReg clarifies that pay-your-bid only corresponds to the price per lot in a given round and bidders will only pay the amount necessary to clear excess demand, rather than at their full valuation (although that may be at valuation which is also possible in opportunity cost pricing).

- Second, an opportunity cost based pricing rule requires bids made in the course of the auction to sufficiently reflect the relative value that bidders place on receiving a different number of lots. If this does not occur, the value of awarded lots to losing bidders (i.e. the opportunity cost) might not be captured in the prices. The use of opportunity cost with the proposed clock auction format creates this risk, as even with exit bids, it may not always be possible for bidders to fully reflect their valuation structures in their bids. This could result in final prices being below the true opportunity cost, which would be contrary to the objective of using the opportunity cost rule in the first place.

2.37 DotEcon also advises that the additional complexity of an opportunity cost pricing rule (beyond auctioneer complexity) should only be offered if there are sufficient expected benefits. Since prices under the proposed rules should be largely reflective of opportunity cost, DotEcon does not envisage any material gain or potential impact on the downstream market(s) from using a more complicated opportunity cost based approach.

2.38 Furthermore, DotEcon regards the opportunity cost pricing rule to only be appropriate with a more complex combinatorial auction format, such as a combinatorial clock auction (CCA) or sealed-bid combinatorial auction, where bidders are given greater flexibility over the range of bids that can be submitted. The use of a second price rule in these formats is intended to provide incentives for bidders to submit bids at valuation, with bidders then paying only as much as they need to win the lots allocated to them[39].

2.39 ComReg agrees with the views of DotEcon. While ComReg has used opportunity cost pricing in previous auctions[40] these awards were characterised by complex lot structures with experienced bidders that provided end services to consumers. In this context, for those previous awards ComReg used different (and more complex) auction formats than the format proposed for this 400 MHz award, where opportunity cost pricing was an important feature of the particular formats implemented for incentivising bidders to submit bids for a range of packages at the maximum price they would be willing to pay.

2.40 In contrast, the current award has a relatively simple lot structure and potentially inexperienced bidders, and ComReg has deemed it appropriate to use a simpler auction format, namely the clock auction with exit bids and combinatorial closing. Here, bidders only need to bid enough in an open auction to outbid

[39] In the proposed simple clock auction, a similar function is achieved by the auction stopping once competition has run its course, with final bids not exceeding bidders' valuations (otherwise they would already have stopped bidding); winning bidders typically do not need to make bids up to their full valuation in the clock format unless they face particularly stiff competition from another bid with a closely similar valuation.

[40] Sealed Bid Combinatorial Auction for the 26 GHz award, and Combinatorial Clock Auction for the 3.6 GHz and MBSA 2012 awards.

other bidders, and in this setting (as set out by DotEcon and discussed above) opportunity cost pricing would not be necessary or appropriate. Furthermore, ComReg does not believe that moving to a more complex auction format where an opportunity cost pricing rule would make sense (such as the CCA or SBCA) would be likely to generate sufficient benefits for it to be justified.

2.41 While any computational complexity could be addressed by ComReg, mechanical and bidding complexity could fall on less experienced bidders[41] which would not be justified given that a similar function is already provided by the SCA and the associated pricing mechanism. Participants in the current award (especially Part B) are likely to be new and unfamiliar with spectrum auctions. In that regard, a pay-your-bid bid rule provides full transparency to bidders about the price they would be required to pay and reduces the scope for bidder error which could arise for smaller bidders who may submit bids in expectation of having to pay a lower price.

2.42 In light of the above, ComReg's final position is that a pay-your-bid pricing mechanism is appropriate for the award process.

Network investment

2.43 ComReg agrees with DotEcon's view that the use of pay-your-bid should still result in final prices[42] that are in line with opportunity cost pricing. The winning bids in a SCA are established through incrementally increasing prices through rounds in order to find a market clearing level[43]. As participants only need to bid just enough to outbid competing demand, the closing price for the winning bidder is likely to be close to the valuation of the next highest bidder (i.e. the opportunity cost price).

2.44 This is particularly true for Part A (where Smart Grid investment would be targeted) where any difference between the price paid and the opportunity cost would be limited by the size of the bid increment in the final round. A small bid increment, as typically used, would limit the extent of any difference, and the potential for exit bids means that the difference might be even smaller. In this regard, and given the relatively low reserve price, ComReg is of the view that any difference between the price paid and opportunity cost is likely to be

[41] For example, bidder error can lead to inefficient outcomes if the bidder who places the highest value on the spectrum fails to acquire that spectrum because of a failure to understand the pricing mechanism correctly and/or adequately submit bids that best reflects its valuation structure.
[42] ComReg notes that 60% of the minimum price is a spectrum usage fee ("SUF") to be paid over the duration of the licence. These annual SUFs are fixed and are not affected by the auction. The remaining 40% of the minimum price is potentially subject to auction
[43] The proposed auction has additional features of exit and closing bids.

negligible compared to ESBNs ongoing investments and would not compromise the rollout of Smart Grid infrastructure.

2.45 For example, a bid increment rule of 5% would correspond to an increment of €12,000 for Part A (in the first round, rising in subsequent rounds) compared to ESBN's annual capital expenditure of €590 million[44]. Further, any exit bids would mean any difference could be less than the bid increment.

2.46 In light of the above, ComReg's position is that the proposed pricing mechanism would be unlikely to reduce investment in the rollout of Smart Grid networks.

2.5 Spectrum Fees

Summary of ComReg's view in Document 19/23

2.47 ComReg was of the preliminary view that the minimum prices should be composed of an upfront Spectrum Access Fee ("SAF") and ongoing stream of SUFs split on a 40/60 basis for both the Part A and Part B awards.

- For Part A, a minimum price of €590,000[45] which comprises an upfront minimum SAF of €240,000 and an annual SUF of €39,000, subject to annual indexation by CPI; and
- For Part B, a minimum price of €19,600[46] for a 2 × 100 kHz lot which comprises an upfront minimum SAF of €8,000 per 2 × 100 kHz lot and an annual SUF of €1,300 per lot, subject to annual indexation by CPI.

2.48 ComReg was also of the preliminary view that the discount rate for Part A and Part B should remain at 8.63% as the cost of capital differs between users, and that these SUFs must be known to all potential bidders prior to the award in order to consider an appropriate valuation of the award spectrum.

Views of Respondents

2.49 ESBN agrees with ComReg's proposal on minimum prices and the 40/60 SAF/SUF ratio, stating that the proposal encourages efficient use of spectrum and allows a bidder to initially allow more funding for the deployment of a network. ESBN also agrees with ComReg that fees should be linked to the CPI and notes that it currently pays fees which are adjusted for CPI.

2.50 In relation to the proposed discount rate, ESBN accepts that ComReg needs to set an appropriate discount rate which covers all potential users of the award spectrum and that it is not possible to know the suitable discount rate for each potential bidder. Nevertheless, ESBN suggests that a discount rate of 4.95% should be applied in a situation where a Network Utility Operator is successful

[44] ESB Annual Report 2019 – p 14.
[45] Discounted at a rate of 8.63%.
[46] Discounted at a rate of 8.63%.

in acquiring spectrum, with no other successful bidders in the award. ESBN submits that this would allow for more funds to be made available for network deployment whilst at the same time achieving the most efficient spectrum release outcome for ComReg.

ComReg's Assessment and Final Position

2.51 ComReg notes ESBN's support of the proposed use of minimum prices, the proposed SAF/SUF structure, and the need for ComReg to set a discount rate which covers all potential users of the award.

2.52 In relation to setting a lower discount, DotEcon notes the arguments previously provided by it in Document 19/23b still apply. In particular, DotEcon notes that:

- it is important for the SUFs to be fixed and known to bidders in advance, as these need to be accounted for when determining how to bid during the auction process[47]; and
- a process in which the SUFs to be paid by a bidder could differ depending on the outcome of the auction (as suggested by ESBN) could create bidding complexity for that bidder, as it would not know which level of SUFs would apply when needing to make their bid decisions.

2.53 ComReg agrees with the views of DotEcon and notes that it is important that all bidders have certainty over the real value of future SUFs so that these can be reflected in individual operator's valuations. Further, as noted in previous consultations, using a cost of capital similar to that of a commercial mobile operator for the purpose of determining the SUFs is appropriate because although this would not be how the spectrum would likely be used, it would represent a potential alternative use for that spectrum and ensure that spectrum rights of use are used efficiently.

2.54 Accordingly, ComReg's position that a discount rate of 8.63% for Part A and Part B remains appropriate and the proposed fee structure will be as follows:

- for Part A, there will be a minimum price of €590,000. This comprises an upfront minimum SAF of €240,000 and an annual SUF of €39,000 subject to annual indexation by CPI; and
- for Part B, there will be a minimum price of €19,600 for a 2 × 100 kHz lot. This comprises an upfront minimum SAF of €8,000 per 2 × 100 kHz lot and an annual SUF of €1,300 per lot subject to annual indexation by CPI.

[47] The sum of the SAF and the SUFs that determine the total a bidder would have to pay for spectrum, so the higher the SUFs the less a bidder would be willing put into the SAF via its bids in the auction.

2.6 Smart Grid Access

Summary of ComReg's view in Document 19/23

2.55 ComReg was of the preliminary view that ex-post competition law should provide sufficient restraint on the winning Network Utility Operator from denying reasonable and necessary access to any other Network Utility Operator/s to a Smart Grid and/or associated spectrum.

2.56 Further, an ex-ante access obligation would require a detailed assessment in advance of the award, to determine how the shared use of a Smart Grid might be provided for. Such information would not be known prior to the award given the uncertainty about who the winning bidder might be.

Views of Respondents

2.57 ESBN accepts that ComReg cannot apply ex-ante obligations without information on users, services etc. Nevertheless, ESBN states that it would welcome principles from ComReg regarding how fair and reasonable access would be determined.

2.58 ESBN is seeking assurances that any ex-post access obligations are not onerous or detrimental to any Network Utility Operator who rolled out a Smart Grid:

- A bidder's network and deployment strategy should not be hindered or impacted by a request for services from another Network Utility Operator, that is, upon a request for access a Network Utility Operator should not have to provide service (and bear the cost of providing this service) in a location that was not intended to be covered until a later stage; and
- ESBN contends that ComReg needs to appreciate that there is an opportunity cost associated with provision of network capacity to another Network Utility Operator and this should be grounds for refusing a request. ESBN cites the proposal to reduce the amount of spectrum available as a potential barrier to satisfying requests.

ComReg's Assessment and Final Position

2.59 With regard to ESBN's requests for guidance and assurances on access matters, ComReg notes that it would not be appropriate for ComReg to provide guidance to ESBN for an event that may or may not occur and where the circumstances of any access request are not known. Any future agreement between ESBN and other Network Utility Operators would be a commercial matter and subject to the same competition rules as other commercial agreements, where compliance with competition law is a matter for the parties

subject to the agreement. In that regard, ComReg notes from ESBN's submission to ComReg Document 19/23 that it already provides other Network Utility Operators with access to ESBN's existing telecommunications network where similar issues are likely to arise.

2.60 Therefore, ComReg's final position is that it would not be appropriate to provide ex-ante guidance on any future access request.

2.7 Location of Unsold Lots

Summary of ComReg's view in Document 19/23

2.61 ComReg was of the preliminary view that it should retain its discretion regarding how it might treat any unsold spectrum lots but envisaged that any unsold lots would be located at the upper end of the Part B spectrum (i.e. 414 MHz / 424 MHz).

2.62 ComReg proposed that specific frequencies could be assigned by ComReg through a random selection process (most likely determined algorithmically), subject to:

- all winning bidders being guaranteed a contiguous block of spectrum; and
- any Part B spectrum won by the winner of Part A would be automatically assigned next to the Part A frequencies.

2.63 Subject to these principles, ComReg was of the preliminary view that any unsold lots should be located on a contiguous basis in the upper range (414 MHz / 424 MHz) of Part B in order to maximise the future availability of spectrum for BB-PPDR, or to create greater interference protection between a potential BB-PPDR requirement and other uses assigned in Part B.

Views of Respondents

2.64 ESBN agrees that ComReg should not provide much detail on potential plans for unsold lots in advance of the award as this could encourage strategic demand reduction.

2.65 ESBN submits that any unsold spectrum should be located in the middle of the band – adjacent to Part A spectrum – so that there is an effective guard band between Part B users and Smart Grid networks.

2.66 ESBN expresses concern with ComReg's proposal to locate any unsold lots in the lower [*sic*][48] section of Part B on the basis that it creates prominence for a potential BB-PPDR user over successful 400 MHz bidders. ESBN contends that

[48] ComReg assumes this is a typographical error as ComReg proposed to locate unsold lots in the upper section of Part B.

any unsold lots should be maintained in the middle of Part B spectrum at the very least, so that Smart Grid and any BB-PPDR users are both afforded equitable protection from interference.

ComReg's Assessment and Final Position

2.67 As noted in Document 19/23, ComReg's proposals on interference protection (Block Edge Masks) as set out below (Section 2.11 and in Annex 2) are sufficient to provide adequate interference protections. In doing so, interested parties may wish to acquire additional spectrum adjacent to their spectrum holdings in order to further reduce any interference concerns.

2.68 Subject to the assignment principles referred to above, any unsold lots will be located in the upper end of the Part B spectrum (that is, 414 MHz / 424 MHz), in order to maximise the potential future availability of spectrum for BB-PPDR and to create greater interference protection between a potential BB-PPDR requirement and other uses assigned in Part B. The location of unsold lots between winning bidders to provide for interference protection would unnecessarily fragment the band and would not provide for the efficient assignment of the radio spectrum given the interference protections already available.

2.69 In light of the above, ComReg's final position is that ComReg will retain its discretion regarding how it might treat any unsold spectrum lots, while locating any unsold lots at the upper end of the Part B spectrum to the extent possible.

2.8 Licence Duration

Summary of ComReg's view in Document 19/23

2.70 In Document 19/23, ComReg maintained its proposal to award 400 MHz spectrum rights of use for a duration of 15 years as:

- it facilitates the periodic coordination and potential realignment of the band as and when required while, at the same time, reducing the potential for licensees to resist changes in the coordination of such bands for strategic reasons;
- the lifetime of the radio infrastructure is likely to be shorter than the lifetime of the physical utility assets due to technical changes;
- based on the 5 year price review in the energy sector, a licence duration of 15 years would allow for 3 price reviews to take place for Smart Grid providers;
- ComReg has outlined a clear approach through its spectrum awards to date that incumbent holders of expiring licenses can expect the spectrum to be re-awarded in a timely manner in advance of expiry.

2.71 This proposal was in line with the assessments of Plum and DotEcon who recommended a minimum licence duration of 15 years.

Views of Respondents

2.72 JRC submits that as Smart Grid is in its infancy, coupled with the acknowledgement that utilities will be required to profoundly change their operating model to implement and harness the benefits of Smart Grid, the sector requires long term certainty over spectrum access. JRC opines that the licence duration should be increased to a minimum of 20 years and ideally 25 years.

2.73 The EUTC believes that a licence duration of 15 years would be of detriment to the energy consumers, stating that by the time the spectrum licence is issued, the telecoms network built, and assets installed it may not be possible to recover the total expenditure within the remaining period of the licence. This could result in assets being scrapped before the end of their working lives to the detriment of consumers and the environment.

2.74 ESBN outlines a number of reasons as to why it believes the licence duration should, at a minimum, be 20 years. ESBN submits that a shorter licence duration would create investment issues for a Network Utility Operator and possibly undermine any investment for the following reasons:

- any development of Smart Grid requires a reasonable period to realise the benefits of deployment to justify investment. ESBN is of the view that equipment deployed as part of a Smart Grid network is likely to be deployed over a period of 20 years as there is no need for refreshing of equipment as takes place in commercial networks;
- ESBN refers to ComReg's observation, in Document 19/23, that a 15 year licence duration would allow for 3 investment cycles. ESBN submits that in practice this observation is not valid, with price review periods taking place from 2021 – 2025, 2026 – 2030 and 2031 – 2035. ESBN acknowledges that a Network Utility Operator could make submissions for Smart Grid funding during the first 2 of these price review periods, however the third price review period would be cut short as a 15 year licence would end in 2034. This makes it difficult to justify funding as it is, in ESBN's opinion, unlikely that the Commission for Regulation of Utilities ("CRU") would look favourably on submissions for funds where the investment could only be realised over the following 4 years;
- a licence duration of 20 years would justify investment in a dedicated nationwide network, whereas a shorter licence duration would result in the business case for Smart Grid not being positive, or the roll out would only be deployed at key strategic locations as these would be most likely to give a return on investment;

- Network Utility Operator's would seek a 20 year licence duration to realise the benefits of investment and not to strategically resist changes as suggested by ComReg in Document 19/23;
- ESBN notes that all respondents to ComReg consultation 18/92 were in favour of a longer licence duration. ESBN refers to the Plum report, which recommends a minimum licence duration of 15 years, and further references to the scanning telemetry in the UK which was introduced over 20 years ago and is still in operation. ESBN also notes that DotEcon in its report suggests there may be valid reasons for a longer licence duration.

2.75 In summary, ESBN opines that to maximise the efficient use of the spectrum the licence period should be 20 years or more to allow for investment certainty.

ComReg's Assessment and Final Position

2.76 ComReg notes the views of respondents that the proposed 15 year licence duration may cause issues for deployment of Smart Grid.

2.77 With regard to suggestions that rollout may only occur in areas where a return on investment is likely, ComReg reminds interested parties that there will be a rollout obligation associated with any 400 MHz Band licence and that this is a condition of any 400 MHz Band licence that may be awarded.

2.78 ComReg notes the views of the EUTC that as licensees will likely be early users of this band, there may not be the opportunity to benefit from economies of scale. ComReg has, in previous documents, referred to ECC Decision (19)02[49], ECC Decision (16)02, 3GPP work item[50], and the current availability of equipment from at least 2 vendors and its opinion that equipment will be available for this band over the near term.

2.79 ESBN has expressed concerns on the difficulty of justifying a Smart Grid business case in order to secure funding from the CRU as a 15 year licence would expire near the end of the price review period. However, with a 20 year licence duration, ESBN would be in a similar situation whereby the licence would expire in 2039, before the end of the 2036 – 2040 price review period.

2.80 Further ComReg notes that a 10 – 15 year duration is consistent with the CRU's view that telecommunications equipment is considered to be 10 – 15 year asset when it is conducting its price reviews[51]. ComReg further notes that a consultancy report for the CRU on electricity transmission and distribution

[49] https://www.ecodocdb.dk/download/02d215ac-295e/ECCDEC1902.pdf
[50] https://portal.3gpp.org/ngppapp/TdocList.aspx?meetingId=18670
[51] CRU Document CER/15/295, Decision on DSO Distribution Revenue for 2016 to 2020 – Section 6.4.

revenue controls by Jacobs states that the depreciation life for telecoms equipment in Smart Grids is 15 years[52].

2.81 ComReg recalls from Document 19/23 that the lifetime of the physical utility assets is cited as a reason for increased licence duration. However, utility assets do not necessarily represent the lifetime of the radio network infrastructure. The lifetime of the radio infrastructure is likely to be much shorter due to technical changes, as pointed out by DotEcon in Document 19/23b. DotEcon considers that where a Network Utility Operator chooses to invest in its own spectrum licence, it should take into account both the changing requirements and other potential means of delivering connectivity that might become available.

2.82 ComReg considers it to be prudent spectrum management to set a licence duration for a maximum of 15 years to (i) ensure that licensees are not locked into using spectrum for longer than may be necessary due to future technology changes; and (ii) in the future there may be other efficient uses that would require access to the spectrum.

2.83 Further, 15 years only represents the expiry of the licence and winning bidders will likely have the opportunity to be reassigned additional rights of use in a new award following expiry.

2.84 In light of the above, ComReg's final position is that 400 MHz Band licences shall be for a maximum duration of 15 years.

2.9 Roll-out Obligation

Summary of ComReg's view in Document 19/23

Part A spectrum

2.85 In Document 19/23 ComReg maintained its proposal that a Network Utility Operator must provide communications to 50% of its utility network, and proposed to extend the time duration to meet this obligation to 7 years as:

- it would better coincide with CRU funding cycles;
- allow licensees time to comply with OJEC procurement rules; and
- in ComReg's view, it would allow licensees sufficient time to meet the proposed rollout condition while ensuring spectrum efficiency.

2.86 ComReg maintained its view that an interested party would be required to submit details of its utility network with its application to partake in any award that may take place.

[52]Jacobs Report Consultancy Support for Electricity Transmission and Distribution Revenue Controls (2016-2020) – Appendix B3.

2.87 ComReg also maintained its view that a licensee would have to submit an annual report on each anniversary of licence commencement, and that on the seventh anniversary it would have to notify the Commission as to whether or not it has met the relevant rollout obligation. Licensees would also be required to register, on an annual basis, the location where wireless telegraphy apparatus operating in Part A spectrum have been deployed.

2.88 ComReg clarified that in the case where a Network Utility Operator wins spectrum in both Part A and Part B, then the roll-out condition for Part A would apply where the entity is using Part B spectrum for the provision of Smart Grid. If Part B spectrum is not being used for the provision of Smart Grid, then the roll-out condition for Part B spectrum will apply.

Part B Spectrum

2.89 In Document 19/23, ComReg maintained its proposed rollout condition and the 3 year duration during which this rollout condition must be met. The proposals represented, in ComReg's view, an efficient use of radio spectrum while also allowing different technology and service types to be deployed.

2.90 ComReg also maintained its view that a licensee would have to submit an annual report on each anniversary of licence commencement, and that on the third anniversary it would have to notify the Commission as to whether or not it has met the relevant rollout obligation. Licensees would also be required to register, on an annual basis, the location where wireless telegraphy apparatus operating in Part B spectrum have been deployed.

Views of Respondents

2.91 The EUTC submits that roll-out conditions are appropriate for commercial mobile networks where consumers in less populated areas are disadvantaged if network operators are not incentivised to provide services outside major urban areas. In contrast, utilities are incentivised to build intelligence into their networks where energy needs are greatest.

2.92 The JRC welcomes the extension of the Part A roll-out obligation to 7 years. However, the reduction in spectrum for the Part B award may cause added complexity and delay in its view and requested that ComReg re-visit the roll-out target in light of same.

2.93 ESBN welcomes the proposal to increase the time to meet the proposed roll-out obligation form 3 to 7 years. ESBN agrees with ComReg that, in the event where a Network Utility Operator was successful in acquiring Part B spectrum, that the conditions associated with Part A would be applied for all the spectrum awarded.

ComReg's Assessment and Final Position

2.94 ComReg notes the submissions received on the issue of rollout. With regard to ESBN's comment, and for the avoidance of doubt, Part A licence conditions, including rollout, would only apply to Part B spectrum where Part B spectrum is being used for the provision of Smart Grid.

2.95 With regard to the EUTC's submission, ComReg has a statutory function, that applies regardless of the intended use of the radio spectrum, under section 12(1)(b) of the Communications Regulation Act 2002, as amended, to ensure efficient use of the radio spectrum. This may be achieved through the implementation of rollout conditions, as set out under Regulation (10)1 of the Authorisation Regulations. ComReg has previously set out the benefits of rollout conditions in ComReg Document 18/92.

2.96 In response to JRC's comment, ComReg does not agree that the reduction of Part B spectrum could lead to added roll-out complexity or delay for any potential users. As ComReg has outlined previously and again in this document, there is already equipment available for the 400 MHz Band, with more equipment likely to come to market in the short term. ComReg is of the opinion that a period of 7 years to meet the Part A roll-out obligation is proportionate and refers readers to its analysis in Document 19/23. With regard to Part B spectrum, the lot size remains unchanged at 2 × 100 kHz, and thus Document 19/23 remains applicable.

2.97 ComReg offers the following clarification with regard to compliance with the rollout obligation and the submission of annual reports. On the anniversary of the commencement date of the licence on which the licensee is to have successfully complied with the proposed rollout condition(s), to the licensee will have to submit a report to ComReg demonstrating compliance. For the avoidance of doubt, the Commission will use the report to, among other things, assess whether or not the licensee has complied with the rollout obligation.

2.98 ComReg's final position regarding roll-out conditions is:

- For Part A spectrum (or where the 400 MHz Band is being used for Smart Grid):
    - a Network Utility Operator must provide communications to 50% of its utility network, within 7 years of the commencement date of the licence;

- a Network Utility Operator must submit details of its utility network with its application, as detailed in the draft Information Memorandum[53], to partake in the 400 MHz award process; and
- a licensee must submit an annual compliance report on each anniversary of licence commencement, and that on the seventh anniversary, using the annual compliance report, the Commission will assess as to whether or not the licensee has met the relevant rollout obligation. Licensees would also be required to register, using the annual compliance report, on an annual basis the locations and type of wireless telegraphy apparatus operating in Part A spectrum have been deployed;
- if a licensee also acquires Part B spectrum and uses it for the provision of wireless connectivity for Smart Grid, then the roll-out condition for Part A will apply to the total quantum of 400 MHz spectrum rights of use held by the licensee.

- For Part B spectrum (or where the spectrum is not being used for the provision of Smart Grid):
  - a licensee shall, by the third anniversary of the commencement date of the licence, achieve and maintain 10 base stations in each of the areas listed below:
    - Area 1 – Carlow, Dublin, Kildare, Kilkenny, Laois, Longford, Louth, Meath, Offaly, Westmeath, Wexford, and Wicklow;
    - Area 2 – Clare, Cork, Kerry, Limerick, Tipperary, and Waterford; and
    - Area 3 – Cavan, Donegal, Galway, Leitrim, Mayo, Monaghan, Roscommon, and Sligo.
  - where a licensee has a base station in one area and this base station is worked and used to provide services to another area, the base station will be counted as being worked and used in the area it serves (and not the area in which it is located);
  - where a licensee has a base station in one area and this base station is worked and used to provide services to more than one area (that is, the area in which it is located in and also neighbouring areas), the base station will only be counted as a single base station for the purposes of meeting the base station obligation and the licensee may choose the area in which such a base station is to be counted for this purpose;

[53] ComReg Document 19/56 – Proposed 400 MHz Band Spectrum Award Draft Information Memorandum and Draft Regulations – Published 12 June 2019.

- a licensee not using the 400 MHz Band for the provision of wireless connectivity for Smart Grid services shall be required to submit to ComReg an annual compliance report on the locations of each of its base stations on each anniversary of licence commencement demonstrating progress made with its roll-out obligation. On the third anniversary of the licence, using the annual compliance report, among other things, ComReg will assess as to whether or not the licensee has met the relevant roll-out obligation.

2.10 Mode of Operation

Summary of ComReg's view in Document 19/23

2.99 In Document 19/23, ComReg outlined a number of reasons why it maintained its view that the 400 MHz Band should be made available for FDD operation only:

- ECC Decision (19)02 gives the least restrictive technical conditions for LTE FDD systems only;
- there is a 3GPP work item to develop a standard for FDD equipment in the 410 – 430 MHz band;
- Plum considered this issue in its assessment of responses, noting that allowing TDD and FDD in the band would likely require guard bands and reduce the amount of spectrum available. Further, if TDD was adopted in Part A spectrum, all other users in the 410 – 430 MHz band would need to adopt the same UL/DL ratio to avoid base station to base station interference;
- ComReg, noting the points made by Plum, observed that this could negatively impact users of both Smart Grid and BB-PPDR as ECC Decision (16)02 describes an FDD configuration for BB-PPDR services operating in the 400 MHz band; and
- ComReg observed that there is equipment currently available in the band that utilises FDD technology.

Views of Respondents

2.100 The EUTC submits that as utilities are ultimately concerned with delivering benefits and reliable services to energy consumers while respecting government energy, safety, social and environmental policies, the communications technology employed to deliver these objectives is largely irrelevant. The EUTC believes that it is therefore best to be as open as possible to alternative technologies and asks ComReg to remain open to both FDD and

TDD alternatives that may facilitate maximum benefit to energy consumers through the most effective technology choice. EUTC further points out that although FDD is more common for large networks at this type of frequency range, TDD enables the optimum capacity balance between upload and download, which is favourable for utilities where the upload path is dominant.

2.101 ESBN requests flexibility on the mode of operation to ensure the optimum use of spectrum by any successful bidder. ESBN states that there is FDD and TDD equipment available in the band and allowing flexibility would benefit a successful bidder as they would have a larger range of equipment and vendors. ESBN believes that ECC Decision 19(02) does not preclude the use of TDD equipment noting that the decision uses the word "could" when listing the frequency ranges in which LTE FDD channels could be used. The decision presents the spectrum bands in paired frequency arrangements, this paired frequency arrangement could be used for FDD or TDD. ESBN contend that ComReg has the option of allowing flexibility within the spirit of ECC Decision 19(02).

ComReg's Assessment and Final Position

2.102 With regard to ECC Decision (19)02, paragraph 5 of the "Decides" section lists frequencies in the 410 – 430 MHz range with the associated uplink and downlink frequency ranges, indicating FDD operation:

- 410 – 415 MHz (uplink) / 420 – 425 MHz (downlink) those specified in Annex 2;
- 411 – 416 MHz (uplink) / 421 – 426 MHz (downlink) those specified in Annex 2; and
- 412 – 417 MHz (uplink) / 422 – 427 MHz (downlink) those specified in Annex 2.

2.103 Further, where ESBN refers to the use of the word "could", this is contained in Annex 2 of the decision document and it is in reference to the different channelling arrangements that may be implemented, and does not refer to the possibility of deploying TDD:

- 1.4 MHz, 3 MHz or 5 MHz LTE; or
- 1.25 MHz CDMA.

2.104 ComReg has, in previous documents, set out its assessment in relation to mode of operation and, as no new supporting evidence has been provided by respondents on this issue, it will not repeat its assessment here. Readers are referred to Document 19/23.

2.105 ComReg's final position on the issue of mode of operation is that 400 MHz Band licences will be made available for FDD operation only.

2.11 Interference Mitigation

Summary of ComReg's view in Document 19/23

2.106 ComReg, in Document 19/23 proposed to adopt the Block Edge Masks ("BEMs") from ECC Decision (19)02 as proposed by Plum as:

- it is based on detailed sharing analysis scenarios involving a range of services presented in ECC Report 283[54];
- it is the agreed least restrictive sharing criteria developed within FM 54 and adopted by the ECC in March 2019; and
- with the BEMs originating from an ECC Decision, it is a good indicator that compliant equipment will be available in the near term.

2.107 ComReg also proposed to increase the UE maximum mean in block power to 31 dBm as this would allow for the deployment of more robust networks. ComReg reiterated its proposal that a 50 W EIRP limit would be applied to all potential licensees. However, ComReg reminded potential licensees that these figures are limits and that the minimum must be used to maintain a network.

2.108 With regard to Radio Astronomy, ComReg proposed that any potential licensee must coordinate with any potential Radio Astronomy users so as to minimise harmful interference due to:

- the allocation of 406.1 – 410 MHz to Radio Astronomy in both the ITU and European Common Allocation Tables; and
- that footnote 5.149[55] of the Radio Regulations and ITU Recommendation RA. 769-2[56] recommend that administrations take all practicable steps to protect the Radio Astronomy service from harmful interference.

Plum states that it is likely that future use of the Radio Astronomy band can be accommodated through careful site selection and coordination with the licensee.

Views of Respondents

2.109 The EUTC submits that conforming to the recommended CEPT BEM will permit the most cost-effective solution while enhancing European Standards on a worldwide basis. The EUTC suggests that the issue of guard bands and restrictive blocks could be addressed in the licence conditions whereby licensees would be required to co-ordinate amongst themselves.

[54] https://www.ecodocdb.dk/download/0353d7fa-80d8/ECCRep283.pdf
[55] https://life.itu.int/radioclub/rr/arsfoot.htm footnote 5.149.
[56] https://www.itu.int/dms_pubrec/itu-r/rec/ra/R-REC-RA.769-2-200305-I!!PDF-E.pdf

2.110 ESBN welcomes and supports ComReg's proposal to:

- adopt the BEMs contained in ECC Decision (19)02;
- to increase the UE maximum mean in block power from 23 dBm to 31 dBm; and
- implement a 50 W EIRP limit.

2.111 ESBN notes ComReg's proposal that any potential licensee must coordinate with any potential Radio Astronomy users so as to minimise harmful interference. ESBN expresses concern that this proposal appears to put the onus on any new licensee to coordinate with any potential user of the Radio Astronomy service, but does not propose that any potential Radio Astronomy user must attempt to protect a new 400 MHz Band licensee.

2.112 ESBN accepts that there should be coordination between the Radio Astronomy service and any new entrant to the 400 MHz Band to mutually avoid interfering with each other but has concerns about this in practice.

2.113 ESBN provides an example whereby a Network Utility Operator has deployed a network, but must alter this network several years later in order to cater for a new Radio Astronomy user. This could result in a Network Utility Operator having to modify or potentially turn off its network in a given area. ESBN asks ComReg to clarify:

- how a Network Utility Operator could prevent against costs incurred due to modification to its own network; and
- would ComReg provide funds or rebates of licence fees in such a scenario.

ComReg's Assessment and Final Position

2.114 With regard to the EUTCs submission on the issue of guard bands, ComReg, in Document 19/23, encouraged all interested parties to internalise guard bands and ensure they have sufficient spectrum to satisfy their requirement.

2.115 ComReg notes the support regarding its proposal to adopt the BEMs in ECC Decision (19)02, to increase the UE maximum mean in block power from 23 dBm to 31 dBm, and to implement a 50 W EIRP limit.

Clarification

2.116 ComReg in part C of Annex 1 of Document 19/23, stated that:

> *"Wanted channel effective radiated power: 40 dBm for user equipment and 53 dBm for base station equipment."*

2.117 ComReg proposed a 50 W EIRP limit and to increase the UE maximum mean in block power from 23 dBm to 31 dBm. ComReg has noted the support for these proposals and so the above should read as follows:

"Wanted channel effective radiated power: 31 dBm for user equipment and 50 W for base station equipment."

2.118 ComReg's final decision is:

- that any potential licensees must adhere to the corrected version of the BEMs in Annex 2 of this document;
- to increase the UE maximum mean in block power from 23 dBm to 31 dBm; and
- to implement a 50 W EIRP limit.

Radio Astronomy

2.119 With regard to ESBN's concerns that the onus appears to be on the 400 MHz Band licensee to protect the Radio Astronomy service, ComReg observes that the Radio Astronomy service is a passive service and so would not cause any interference to a potential 400 MHz Band licensee. ITU Recommendation RA 769-2 and to footnote 5.149 of the Radio Regulations, both of which ComReg has referred to in Document 19/23, state that Administrations must take all practicable steps to protect the Radio Astronomy service. ComReg, in proposing this licence condition, is taking consideration of these recommendations.

2.120 In a situation where a licensee had to adopt its network due to the deployment of a Radio Astronomy service, that licensee would not be entitled to any funds or rebates from ComReg. In deciding whether to participate, bid and potentially win spectrum in the 400 MHz Band award, an interested party must take this possibility into consideration when formulating its bid strategy and valuations.

2.121 ComReg's final position is that any potential licensee must coordinate with any potential Radio Astronomy users so as to minimise harmful interference.

2.12 Memorandum of Understanding

Summary of ComReg's view in Document 19/23

2.122 ComReg, in Document 19/23, stated that it would engage Ofcom to define a new Memorandum of Understanding ("MoU") and will publish details of the MoU once finalised.

Views of Respondents

2.123 The EUTC submits that it and its members are at ComReg's disposal to assist in international coordination for radio spectrum to be used by utilities. The EUTC encourages spectrum harmonisation and coordination on a European basis to facilitate lowest cost solutions and enhance Europe's industrial strengths.

2.124 ESBN observes that the existing MoU is not fit for purpose, should be re-examined and is disappointed that it appears discussions have not yet begun. Further ESBN believes ComReg should consult on any proposed MOU.

ComReg's Assessment and Final Position

2.125 ComReg notes respondents' views that the existing MoU needs to be updated. ComReg can confirm that it, with Ofcom, has begun work on an updated MoU and will publish details of the MoU in due course. Please note that such MoUs enable the co-ordination of the use of radio spectrum across international borders. As these MoUs normally reflect ITU and ECC decisions or recommendations but can also deal with issues of national security and other sensitivities, they are therefore not subject to consultation.

2.13 Third Party Use

Summary of ComReg's view in Document 19/23

2.126 ComReg was of the preliminary view that a structure similar to that of the Third Party Business Radio licensing scheme would apply to any third party use in the 400 MHz Band, in particular that:

- the licensee is the entity that partook in the proposed 400 MHz Band award and is responsible for ensuring that it complies with the conditions contained in the licensing regulations and schedules, ensure payment of fees, and compliance with any relevant international agreements relating to the use of apparatus or the frequencies assigned.

2.127 ComReg also reiterated that, for the avoidance of doubt, any third party use would only be permitted in Part B spectrum (that is, where the spectrum is not being used for the provision of Smart Grid).

ComReg's Assessment and Final Position

2.128 ComReg did not receive any submissions regarding third party use.

2.129 ComReg's final position is that third party usage in the 400 MHz Band will mirror that of Third Party Business Radio and:

- the licensee is the entity that partook in the proposed 400 MHz Band award and is responsible for ensuring that it complies with the conditions

contained in the licensing regulations and schedules, ensure payment of fees, and compliance with any relevant international agreements relating to the use of apparatus or the frequencies assigned; and

- third party use will only be permitted where the 400 MHz Band is not being used for the provision of Smart Grid.

Chapter 3

3 Final RIA

3.1 In 2005, ComReg auctioned three national licences for Wideband Digital Mobile Data Services ("WDMDS") in the ranges 410 – 414 MHz paired with 420 – 424 MHz and 872 – 876 MHz paired with 917 – 921 MHz[57]. No commercial services were ultimately deployed in those frequency ranges and the rights of use expired on 31 December 2017.

3.2 In its Radio Spectrum Management Strategy Statement 2016 to 2018, ComReg observed that a number of potential uses for the 410 – 414 MHz / 420 – 424 MHz band required consideration and stated that it would consult on the future use of the band as part of its 2016 – 2018 work plan[58]. ComReg has further indicated its intention to conclude the consultation process on the 400 MHz Band in its Radio Spectrum Management Strategy Statement 2019 – 2021[59].

3.3 In 2017, ComReg published Consultation 17/67[60] which noted that a RIA would form part of future consultations on the 400 MHz Band depending on the measures proposed. This RIA now examines how rights of use in the 400 MHz Band should be awarded. It concludes with an assessment of the Preferred Option against ComReg's statutory remit, including relevant functions, objectives and principles (as outlined in Annex 1).

RIA Framework

3.4 A RIA is an analysis of the likely effects 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

[57] ComReg Document 05/80 – Information Memorandum: Process for the award of national licences for the provision of WDMDS – published 20 October 2005. Note: this document is not publicly available as it was only accessible through purchase. However, the majority of details in the Information Memorandum are covered at a high level in ComReg Document 05/79 – Information Notice.
[58] ComReg Document 16/50 - Radio Spectrum Management Strategy 2016 to 2018 – Published 21 June 2016.
[59] ComReg Document 18/118 – Radio Spectrum Management Strategy Statement 2019 – 2021 – Published 20 December 2018.
[60] ComReg Document 17/67 - Consultation on Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published 31 July 2017.

ensure that all proposed measures are appropriate, effective, proportionate and justified.

Structure of a RIA

3.5 As set out in ComReg's RIA Guidelines[61], 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 impact on competition; and
- Step 5: Assess the impacts and choose the best option.

3.6 In the following sections ComReg identifies the relevant stakeholder groups, specific policy issues to be addressed, and relevant objectives (Step 1 of the RIA process).

3.7 This is followed by identification of policy issues and ComReg's consideration of same in accordance with Steps 2-5.

Policy Issues and Objectives (RIA Step 1)

3.8 Document 17/67 explored, at a high level, possible uses for the 400 MHz Band and how it might be assigned. In response to concerns expressed by eir Group[62] [63] ComReg noted in Response to Consultation 17/105[64] that the award of the band would respect the principles of service and technology neutrality. ComReg also noted that it would form a preliminary view on the matters discussed, in the next consultation phase and having considered responses together with other evidence, including expert advice obtained in the intervening period. In particular, ComReg stated that it would prepare a draft RIA on the assignment

[61] ComReg Document 07/56a – Guidelines on ComReg's approach to Regulatory Impact Assessment – Published 10 August 2007.
[62] Eircom Limited (trading as "eir" and "open eir") and Meteor Mobile Communications Limited ("MMC") (collectively referred to as "eir Group").
[63] ComReg Document 17/105s – Non-Confidential Submissions to ComReg Document 17/67 on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published 8 December 2017.
[64] ComReg Document 17/105 – Response to Consultation on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published 8 December 2017.

process for the 400 MHz Band which would be informed by responses to Document 17/67.

3.9 In that regard, and in light of certain matters raised by respondents, ComReg commissioned Plum to analyse potential uses of the 400 MHz Band as identified in Consultations 17/67 and 17/105, to identify any other possible uses, to assess how much spectrum may be needed for those uses, and to assess possible technical requirements. The Plum report was published alongside Document 18/92[65]. An updated version of the Plum report was published alongside Document 19/23, taking account of responses to Document 18/92[66].

3.10 Among other things, Plum assessed four broad categories of potential uses for the 400 MHz Band: Private/Professional Mobile Radio ("PMR"); Public Protection and Disaster Relief ("PPDR"); Smart Meters; and Smart Grids. See Table 4.3 of the Plum report. For each identified use, Plum assessed a number of factors including:

a) the applicable technology(s) and future availability;

b) the minimum spectrum block requirements; and

c) the availability of alternative frequency bands and/or solutions.

3.11 The assessments under bullets (a) and (b) were discussed separately in the Award design Chapter.

3.12 In relation to (c), Plum concludes that PMR has alternative frequencies and or solutions available that can be used to deliver those services. For instance, a significant number of alternative bands are available for PMR[67], and TETRA Enhanced Data Services ("TEDS")[68], and Smart Meters[69] However, Plum outlines that there are no alternative spectrum rights of use sufficient to provide for Smart Grid. In particular, sub 1 GHz spectrum is required to connect to sub-stations, pumping stations, and alternative energy sources and, to achieve necessary geographic coverage over remote rural locations.

[65] ComReg Document 18/92b Plum Consulting London LLP - Potential use of the 400 MHz band in Ireland Published October 2018.
[66] ComReg Document 19/23a Plum Consulting London LLP – Potential use of the 400 MHz band in Ireland Published March 2019.
[67] For example, 440 – 450 MHz for land mobile, 455 – 456 MHz for PMR, digital land mobile civil, 456 – 469 and 460 – 470 MHz or land mobile for Government service, commercial and local authorities, and 459 – 460 MHz for land mobile. PMR / PAMR already supported in licensed bands.
[68] For example, 380 – 385 paired with 390 – 395 MHz for the emergency services, and 385 – 389.9 paired with 395 – 399.9 MHz for a civil network. Current TETRA network 380 – 385 / 390 – 395 MHz.
[69] Smart Meters can be provided over MNO networks (for example, NB-IoT in LTE spectrum bands) and licence exempt bands such as 868 MHz. For example, ESB Networks has announced three successful tenders for the upgrade of the National electricity meter replacement programme. Three Ireland was selected to provide the ICT network.

3.13 The only alternative suitable spectrum for Smart Grid is the 450 – 470 MHz band, currently assigned for and used extensively by PMR (Business Radio). However it is unsuitable because the 2 × 3 MHz of contiguous spectrum required for Smart Grid use, as identified by Plum, is not available. See Figure 1 of Annex 3.

3.14 The 450 – 470 MHz band is used for many applications including Business Radio, Paging, Third Party Business Radio, Data/Telemetry, PMSE and Community Repeaters. Business Radio currently uses most of the band – there are currently about 600 individual frequency assignments. Plum also notes that Smart Grid networks, covering large and often rural areas, necessitates spectrum around 400 MHz and use of other bands would not be optimal.

3.15 Plum sees little demand for the 400 MHz Band for other uses identified as there is enough available spectrum elsewhere to meet demand. For example, Plum notes that most use cases already have access to spectrum and, as regards PPDR, ComReg has provided for its possible future use in part of the 400 MHz Band by reducing the amount of spectrum in Part B of the proposed 400 MHz award. There are also alternative solutions emerging for such use cases such as provision of PPDR[70] and Smart Metering over MNO networks[71].

3.16 ComReg agrees with Plum (whose views are unchanged having considered responses to Document 19/23) and remains of the view that no suitable alternative spectrum is available for Smart Grid use. This view is consistent with responses to Documents 17/67[72] and 18/92[73] that suitable alternative spectrum is not available for wideband utility networks or Smart Grids[74].

[70] In particular, the 700 MHz EC Decision gives Member States flexibility in terms of the potential uses of the 700 MHz band including the 700 MHz Duplex Gap and guard bands, including for PPDR. To date, no national policy decision has been taken in relation to the specific use of the 700 MHz band including the 700 MHz Duplex Gap and guard bands in Ireland and, in particular, in respect of PPDR. Moreover, in line with ECC Decision (16)02, ComReg is minded to make available 2 × 3 MHz of spectrum for the provision of BB-PPDR in the 400 MHz Band by reducing the spectrum available in this award from 2 × 5.5 to 2 × 4 MHz.

[71] For example, O2 are providing connectivity for smart meters to over 23 million locations in the UK - https://www.o2.co.uk/business/iot/solutions/smartmeters

[72] In their submissions to Document 17/67, ESBN ("Electricity Supply Board Networks") and EUTC (European Utilities Telecommunications Union) agreed that alternative and suitable rights of use are not available for wideband utility networks and the provision of Smart Grid. These submissions are contained in Document 17/105s.

[73] NIE Networks ("Northern Ireland Electricity Networks"), ESBN and EirGrid agreed that alternative and suitable rights of use are not available for the provision of Smart Grid. These submissions are contained in Document 19/23s.

[74] ComReg Document 17/105s - Non-Confidential Submissions to ComReg Document 17/67 on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published December 2017.

3.17 The lack of suitable alternative spectrum for Smart Grid raises two important policy considerations that require ComReg's consideration.

1. Is there a likely requirement for Smart Grids in Ireland?

2. Are there alternative solutions that could deliver a Smart Grid(s)?

3.18 These policy considerations are assessed below. Prior to that assessment, it is helpful to provide information and a definition of Smart Grids in order to provide context to the remainder of this RIA.

What are Smart Grids?

3.19 Various definitions of a Smart Grid are in use. This response to consultation uses a definition provided by Plum which is based in part on the definition used by the International Telecommunications Union ("ITU")[75].

3.20 Plum defines Smart Grid as "a term used for advanced delivery systems for utility services (electricity, gas and water) from sources of generation and production to key elements in the grid networks and includes all supervisory and control necessary for their effective management"[76].

3.21 A Smart Grid enables two-way data flows between various parts of a utility network. At the core of the Smart Grid is the use of intelligent communication networks. This brings together the monitoring and control functions and enables analysis of various parts of the utility system; for example - power generation or transmission and distribution. Smart Grids have many more elements and sensors than legacy grids[77] and these are deployed at all levels of the grid such as power plants, substation equipment, generators and transformers. The sensors are used for data acquisition and information exchange between equipment and data centres. In order to handle the increased amount of data, a Smart Grid requires reliable and resilient infrastructure that provides secure real-time communications[78].

[75] The International Telecommunications Union ("ITU") defines Smart Grid as follows: "Smart Grid is a term used for advanced delivery system for utility services (electricity, gas and water) from sources of generation and production to consumption points, and includes all the related management and back office systems, together with integrated modern digital information technologies." Smart Grid Utility Management Systems, Report ITU-R SM.2351-2 06/17.
[76] As noted by Plum this definition does not include Smart Metering which is a use case considered separately in its report and has alternative frequencies and solutions available.
[77] The legacy grid communication systems are mainly used for data acquisition from limited number of sensors that are located in the main transmission and distribution points, limited number of control signals transmission and faults detection.
[78] Baimel, D, 2016, Smart Grid Communication Technologies, Journal of Power and Energy Engineering, 2016, 4, 1-8.

3.22 Existing utility distribution systems are designed to deliver resources uniformly, regardless of variations in demand at different times and places. These systems lack the intelligence to optimise delivery in response to demand leading to more inefficient delivery and use. A Smart Grid uses more data and better data analysis through better communication systems to optimise delivery in response to demand, improving cost-effectiveness of grid infrastructure investments and increasing the reliability of the distribution system for end users.

1. Is there a likely requirement for Smart Grids in Ireland?

3.23 ComReg considers it necessary to assess whether Smart Grids are a viable service proposition likely to require spectrum rights of use in the period up to the end of the licence[79]. Below are ComReg's final views as to whether there is demand for spectrum for the provision of Smart Grids, noting that any actual demand can ultimately only be determined through the process of interested parties seeking to obtain spectrum for Smart Grids and being assigned same.

3.24 Smart Grids are a key component of government efforts to meet the demand for energy in a cost effective and secure way while also reducing the environmental impact (including carbon emissions)[80]. A Smart Grid, using new technology, could result in substantial reductions in energy use and carbon emissions and could make renewable energy and efficiency programs more affordable and accessible.

3.25 Greater integration of renewable energies into electricity and gas grids is key to lowering the environmental impact and meeting climate change targets:

- The ITU has outlined how Smart Grids can help to mitigate climate change by building more controllable and efficient energy systems[81]; and
- The UN has outlined that climate change requires development of Smart Grids founded on communications networks that can deliver centralised real time monitoring and control, eventually across the entire power distribution domain[82].

3.26 A number of international and national studies estimate the carbon reductions from using Smart Grids:

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[79] See Section 2.8 (Licence Duration).
[80] Transition to a Low Carbon and Climate Resilient Society – National Strategic Outcome 8 of the National Development Plan 2018 – 2027. https://www.gov.ie/pdf/?file=https://s3-eu-west-1.amazonaws.com/govieassets/831/130718120306-5569359-NDP%20strategy%202018-2027_WEB.pdf#page=76
[81] https://news.itu.int/energy-efficiency-fight-climate-change-vital-role-icts/
[82] United Nations Economic Commission For Europe, Electricity Systems Development – A Focus on Smart Grids, August 2015.

- the Electrical Power Research Institute ("EPRI")[83] has estimated that Smart Grid enabled electrical distribution could reduce electrical energy consumption by 5% to 10% and carbon dioxide emissions by 13% to 25%[84];
- a smart electrical power grid could decrease annual electric energy use and utility sector carbon emissions by at least 12% by 2030[85]; and
- the Sustainable Energy Authority of Ireland estimates that by 2050, Smart Grids will see an accumulated reduction in energy related CO_2 emissions of 250 million tonnes[86] [87].

3.27 The European Commission also encourages use of Smart Grids for more efficient energy generation and consumption. The Electricity Directive states:[88]

- *"Member States should encourage the modernisation of distribution networks, such as through the introduction of* ***smart grids****, which should be built in such a way that encourages decentralised generation and energy efficiency*"[89]
- "*In order to promote energy efficiency, Member States or, where a Member State has so provided, the regulatory authority shall strongly recommend that electricity undertakings optimise the use of electricity, for example by providing energy management services, developing innovative pricing formulas, or introducing intelligent metering systems or* ***smart grids****, where appropriate*"[90] [91]
  [Emphasis added].

[83] ComReg notes that the EPRI recently formed a new entity in Dublin (EPRI Europe), which will be the central hub for an array of smart grid research projects in Europe.
https://www.siliconrepublic.com/innovation/smart-grid-research-europe-dublin-epri
[84] Smart Grid Utility Management Systems, Report ITU-R SM.2351-2, 06/17.
[85] The Smart Grid: An Estimation of the Energy and CO_2 Benefits, Department of Energy's Pacific Northwest National Laboratory.
[86] https://www.seai.ie/resources/publications/Smartgrid-Roadmap.pdf
[87] The Effort Sharing Regulation (ESR), was published by the European Commission in July 2016. The ESR proposal suggests a 39% GHG (Greenhouse Gas) reduction target for Ireland, based on GDP per capita, for the period 2021 to 2030.
[88] Note that references to the Electricity Directive are made to indicate demand or a requirement for Smart Grid rather than ComReg being subject to any specific requirements under those Directives.
[89] Recital 24 – Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2008.
[90] Article 3(11) – Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2008.
[91] The development of technology to deliver more efficient management of networks is more commonly known as Smart Grids. The new systems will improve efficiency, reliability, flexibility and accessibility and are the key next steps in the evolution of the internal market in energy Interpretative Note on Directive 2009/72/EC Concerning Common Rules for the Internal Market in Electricity and Directive 2009/73/EC concerning Common Rules for the Internal Market in Natural Gas.

3.28 The European Commission's policy framework for climate and energy from 2020 to 2030 proposes new targets and measures to make the EU's economy and energy system more competitive, secure and sustainable. It includes targets for reducing greenhouse gas emissions and increasing use of renewable energies noting that "*the EU and Member States will need to develop further their policy frameworks to facilitate the transformation of energy infrastructure with more cross-border interconnections, storage potential and* ***smart grids*** *to manage demand to ensure a secure energy supply in a system with higher shares of variable renewable energy*"[92]
[Emphasis added]

3.29 In December 2018, the Minister for Communications, Climate Action and the Environment, Richard Bruton T.D. submitted to the European Commission the first draft of Ireland's National Energy and Climate Plan (NECP) one of the key provisions of the proposed Governance of the Energy Union Regulation. The NECP sets out how Ireland will reduce carbon emissions and increase renewable energy up to 2030. The NECP includes trajectories for renewable energy, energy efficiency, and national emissions and measures to achieve these trajectories[93]. In relation to Smart Grids:

- Smart technologies and grids are one of the NECP's key objectives in achieving a fully integrated energy market;
- Smart Grids are one of a number of key measures required to increase the flexibility of the existing energy system with regard to renewable energy production and the NECP includes a case study of pilot programme launched by ESBN as an example of the benefits of Smart Grids;
- Smart Grids are one of the key electricity and gas transmission infrastructure projects needed for the NECP to meet its objectives;
- The NECP supports improved and increased gas and electrical infrastructure, through efficient and effective projects and wide implementation of Smart Grid technology; and
- A new grid development strategy to support the NECP is suggested as is infrastructure to link high penetration of renewables in the South and West of Ireland to high demand regions in the East.

[92] European Commission, 'A policy framework for climate and energy in the period from 2020 to 2030, (COM(2014) 15 final), January 2014.
[93] https://www.oireachtas.ie/en/debates/question/2018-05-30/198/

3.30 Such requirements are also broadly in line with other State policies to encourage the provision of Smart Grid and other related technologies:

- The governments Climate Action Plan 2019[94] which puts in place a decarbonisation pathway to 2030 which would be consistent with the adoption of a net zero target in Ireland by 2050. The plan also commits to evaluating in detail the changes (including Smart Technologies) which would be necessary in Ireland to achieve this target.
- The government's 2015 Energy White Paper, '*Ireland's Transition to a Low Carbon Energy Future 2015-2030*' sets out a framework to guide Irish energy policy in the period up to 2030 by, among other things, moving to lower emissions fuels significantly increasing renewable generation and implementing smart and interconnected energy systems[95];

- The Project Ireland 2040 National Planning Framework[96] promotes a transition to a low carbon energy future which requires decisions around developing and deploying new technologies for areas such as wind, **smart grids**, electric vehicles, buildings, ocean energy and bio energy. It also commits to roll-out of the National Smart Grid Plan enabling new connections, grid balancing, energy development and micro grid development;

- The Department of Communications, Climate Action and Environment National Mitigation Plan observes that smart operation of the power system at both transmission and distribution level and energy efficiency will enable maximisation of the existing grid[97];

- The National Development Plan 2018 – 2027 foresees the piloting of 'climate-smart countryside' projects to establish the feasibility of the home and farm becoming net exporters of electricity through the adaptation of smart metering, **smart grids** and small-scale renewable technologies, for example, solar, heat pumps and wind; and

[94] Climate Action Plan 2019 https://www.dccae.gov.ie/documents/Climate%20Action%20Plan%202019.pdf
[95] https://www.dccae.gov.ie/documents/Energy%20White%20Paper%20-%20Dec%202015.pdf
[96] Project Ireland 2040 - National Planning Framework – 2018.
[97] Department of Communications, Climate Action and Environment - National Mitigation Plan – July 2017.

- The Sustainable Energy Authority of Ireland "Smart Grid" Roadmap to 2050[98] notes that Smart Grid can maximise our use of indigenous low carbon renewable energy resources which is central to ensuring Ireland meets its long term target of a secure and low carbon future.
  [Emphasis added throughout]

3.31 At least one Network Utility Operator (ESBN) has publicly expressed an interest in acquiring 400 MHz spectrum to support the provision of a Smart Grid[99]. As to other utilities, the requirement for Information and Communications Technology ("ICT") in the water distribution network is documented by the ITU[100]. Sensors placed throughout the water distribution network are needed to save water. Such systems manage end-to-end distribution from reservoirs to pumping stations to smart pipes, allowing water utilities to identify leaks in real time and reduce the approximately 50% of water that, in developed countries, is lost through leaks[101].

3.32 Expert Group 4 of the EU Commission task force for Smart Grids examines Smart Grid aspects related to gas[102]. It has stated that Smart Gas Grids will support the ability of gas to play a major ongoing role in the energy mix while meeting carbon and renewable energy targets (targets outlined by the European Commission and discussed earlier). It has also stated that Smart Gas Grids empower end-users to optimise their energy use and allows them to participate actively in the energy market. A gas Smart Grid also enables injection of non-conventional gases, such as Biomethane which is CO_2 neutral, into the network, reducing the carbon intensity of the Gas Grid.

3.33 Finally, ComReg notes that other EU Member States are also addressing spectrum demand for Smart Grids:

- Germany has initiated a process to operate critical infrastructures (including Smart Grids) nationwide on a technology neutral basis[103]. BNetzA, the German regulator, considers the 450 MHz range suitable for applications for such critical infrastructures.

[98] Sustainable Energy Ireland, Smart Grid 2050.
[99] ComReg Document 17/105s - Non-Confidential Submissions to ComReg Document 17/67 on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published 8 December 2017 and ComReg Document 19/23s – Non-Confidential Submissions to ComReg Document 18/92 on the Proposed Release of the 410 – 414 / 420 – 424 MHz sub-band – Published March 2019.
[100] https://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000100003PDFE.pdf
[101] https://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000100003PDFE.pdf
[102] https://ec.europa.eu/energy/sites/ener/files/documents/2010-2011.zip
[103] https://www.bundesnetzagentur.de/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Frequenzen/Firmennetze/450MHz/450MHz-node.html

- The Polish Office of Electronic Communications ("UKE") recently assigned 450 MHz spectrum rights of use to PGE Systemy S.A., part of Poland's largest energy company, to provide voice and data communications in its transmission and distribution networks for gas, liquid fuels and electricity[104].

3.34 ComReg's final view is that a Smart Grid is likely to be required to meet various national and international policy goals and is likely to be a viable proposition in the period up to the end of the licence.

2. Are there alternative solutions that can deliver a Smart Grid(s)?

3.35 To ensure the Preferred Option is proportionate, it is necessary to assess whether a Smart Grid in Ireland could be provided without 400 MHz spectrum. ComReg must determine if there are viable alternatives. ComReg does this by first assessing the technical requirements for Smart Grid and then assessing how much spectrum is needed to support those requirements.

(i) What are the technical requirements of Smart Grids?

3.36 Plum identifies several requirements for effective Smart Grids:

- low to medium data rates typically 9.6 Kbit/s to around 64 Kbit/s and up to multiple Mbit/s if video is required to monitor key installations;
- grid networks are expected to be deployed for a significant time (for example, 10 to 20 years);
- low jitter and synchronous requirements;
- enhanced resilience – for example this requires battery power back-up which far exceeds that provided over MNO networks;
- instant and guaranteed channel access;
- extensive geographic coverage (including less populated areas) to provide 100% coverage of the utility network;
- stringent latency requirements; and

[104] https://bip.uke.gov.pl/konsultacje-i-wyniki-konsultacji/komunikat-ws-przetargu-na-rezerwacje-czestotliwosci-zzakresow-452-5-457-5-mhz-oraz-462-5-467-5-mhz,378.html

- high levels of security[105].

3.37 Further, ComReg observes that in September 2017, the CEPT working group FM 54[106] agreed to draft some elements for a further revision of ITU-R Report SM.2351-2[107] to include PMR/PAMR technologies already in use. In May 2018, WGFM approved this proposed revision as a CEPT contribution to be sent to ITU-R Working Party 1A[108] for consideration. That contribution (referred to as the "CEPT contribution") was submitted by the United Kingdom on behalf of WGFM/CEPT. The Plum report is largely in line with the updated "CEPT contribution". In particular, the CEPT contribution notes that while recent developments in commercial telecommunications networks facilitate carriage of critical communications, mission critical utilities still have several uniquely demanding requirements:[109]

- Utility telecommunications growth comes from increasing the geographic coverage of the monitoring networks, numbers of connection points, and speed of response, rather than necessarily increased data rates;
- Geographic coverage availability requirements (for example, up to 99.999% for power line protection and 99.9% for scanning telemetry systems) within the defined service area including, in some cases, remote and unpopulated areas[110];
- Enhanced resilience to enable networks to operate in the absence of main electric power for an extended period, which may extend from a few minutes to 72 hours, and even beyond;
- Network hardened to ensure resilience against severe weather, including high winds, flooding, snow, icing, extreme temperatures, and electromagnetic disturbances such as lightning strikes;
- System reliability needs to be designed to meet exact technical requirements rather than for economic gain;
- Separate, independent and diverse redundant routing. Note: when the

[105] Network security, confidentiality, data and user privacy, network integrity and availability.
[106] https://cept.org/ecc/groups/ecc/wg-fm/fm-54/client/introduction/
[107] ITU-R Report SM.2351-2 on Smart Grid utility management.
[108] ITU Working Party 1A developed a preliminary draft revision of ITU- R SM.2351-2 during its meeting in Geneva from 4-12 June 2018. The draft has been further discussed at the latest meeting of Working Party 1A (28 May to 5 June 2019).
[109] https://www.cept.org/Documents/fm-54/43494/fm54-18-25_reporting-from-wgfm91-may-2018-incl-relevant-annexes
[110] For example, power lines traverse remote regions where there is little population. Renewable energy and water resources are also often in remote locations. These remote and unpopulated areas may not attract commercial telecom operator services. The CEPT contribution notes that "*The coverage of the commercial 3GPP networks is targeted to population centres and cannot in general be relied on in isolated non-populated areas across which utility supplies must frequently be carried and controlled*."

primary route is interrupted, it is essential that the diverse route works immediately and correctly. This is especially true when instant access to radio spectrum is required;

- Access to suitable allocated spectrum is preferred so that expansions and enhancements to the grid control network may be planned with confidence and incorporated speedily;
- Utilities need high levels of security for their telecoms networks, and infrastructure sites, not only in terms of integrity to prevent malicious disruption of utility operations; but also guaranteed access where denial of service occurs either from network congestion or malicious intent, denying the utility visibility of its network;
- Telecom signal latency and asymmetry requirements in the electricity industry are linked to voltage / power levels, requiring latencies as low as 6 ms with associated asymmetry of less than 300 µs if protection systems are to function correctly. These requirements emerge from the need to compare 'in cycle' values across an electricity network in real time where the duration of a half-cycle is needed to maintain stability and accurately identify fault; and
- Whereas commercial networks are inherently download-centric, utility networks are upload-centric with a small number of control rooms remotely monitoring large geographic areas.

3.38 With regard to the above outline of requirements unique to mission critical utilities, ComReg notes that any potential alternative solutions, networks or frequencies would need to provide for each of the requirements outlined by Plum and CEPT. In particular, these requirements largely arise from the need for a Smart Grid to react effectively to changes in the conditions of generation and transmission, and that access to a Smart Grid should not be compromised[111]. If there is a need to shut these down due to conditions such as overload, full coverage across all connected elements is paramount and delays of milliseconds can be serious, hence network availability, reliability, resilience and security is essential. In the case of water supply there can be similar requirements to monitor key points in the water network such as the flow of water in major pipe lines or water levels in areas prone to flooding where it may be necessary to open or close various valves and dams to alleviate such risks[112].

[111] Smart Grids typically contain multiple network devices, such as transformers, and switches each of which each could be vulnerable to network interference.
[112] Document 19/23a, Plum Report, 'Potential use of the 400 MHz band in Ireland' 2018, p12.

(ii) How much spectrum is required to support the Smart Grid?

3.39 Plum is of the view that Smart Grid requires 2 × 3 MHz of contiguous spectrum. This is primarily based on the expectation that LTE technology will be required to deliver the technical requirements as set out above and that equipment for LTE in the 410 – 430 MHz band will be in FDD mode and use a minimum bandwidth of 3 MHz (that is, a total of 2 × 3 MHz).

3.40 Similarly, ETSI, also recommends that the shortfalls in bandwidth required for Smart Grid would be overcome if an allocation of spectrum, for example, 2 × 3 MHz in the 400 MHz Band, for Utility Operations systems were to be made available[113]. Further, ETSI recommends that in an ideal scenario, a harmonised tuning range could be found across Europe, in the 450 MHz to 470 MHz band. However, where this is not possible, 2 × 3 MHz anywhere within the 400 MHz Band (380 MHz to 470 MHz) will be acceptable. Further, ETSI note that ultimately, the need for real-time video, and other high speed data services, will only become clear as Smart Grids are rolled out. This would indicate that video and the need for additional spectrum to support use of same is not presently a central requirement for Smart Grids[114] [115].

3.41 In light of the views of Plum and ETSI, ComReg's final view is that 2 × 3 MHz of contiguous spectrum in the 400 MHz Band is required to provide a Smart Grid in Ireland.

Are viable alternatives available to support Smart Grid?

3.42 ComReg is of the view that there are two possible alternatives for providing a Smart Grid - (a) existing telemetry systems or (b) existing mobile networks. ComReg assesses each possible alternative against the technical requirements set out by Plum and CEPT.

(a) Existing telemetry systems

3.43 Plum notes that utility networks have historically been monitored using telemetry systems, to provide necessary command and control of a centralised grid network. Telemetry systems gather data from a limited number of sensors

[113] ETSI, 'Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements', November 2016. ETSI TR 103 401 V1.1.1 (2016-11).
[114] ETSI, 'Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements', ETSI TR 103 401 V1.1.1 (2016-11).
[115] ETSI, 'Critical Infrastructure Utility Operations requirements for Smart Grid systems, other radio systems, and future radio spectrum access arrangements below 1,5 GHz', January 2019. ETSI TR 103 492 V1.1.1 (2019-01).

located at main transmission and distribution points. This provides for a limited number of control signals and fault detections[116][117].

3.44 However Plum notes that utility networks are changing to new distributive models, requiring a new level of control, and this cannot be met using legacy technology and available spectrum. In particular, existing telemetry systems cannot support the bandwidth requirements for Smart Grids as recommended by ETSI and Plum. For example, ESBN's existing telemetry assignments in the 450 – 470 MHz band consist of 2 × 300 kHz[118] (two blocks, each comprising 12.5 kHz channels). That is ten times less spectrum than the 2 × 3 MHz recommended by Plum and ETSI.

3.45 Further, the shift from fossil fuel to renewable energies requires more points in the network because renewables, like wind, tend to be generated across many small generation points, often in remote areas, whereas a small number of large generators use fossil fuels. The number of remote rural links is thus predicted to increase by between ten-fold and twelve-fold. Telemetry systems are unlikely to have enough bandwidth or spectrum to support an increase of such magnitude [119] [120].

3.46 ComReg therefore remains of the view, shared by Plum, that current telemetry systems are unlikely to be suitable for the provision of Smart Grids, up to 2040.

(b) Mobile Networks

3.47 A number of the technical requirements outlined above, could be provided by mobile networks to support certain Smart Grid applications. These include:

- low to medium data rates - typically 9.6 Kbit/s to around 64 Kbit/s and up to multiple Mbit/s if video is required to monitor key installations; and
- grid network deployed for 10 – 20 years.

3.48 Mobile networks offer high rates of data transfer and implement security algorithms[121]. However they do not appear to satisfy most of the technical

[116] Smart Grid an optimal solution to economic and environmental benefits. International Journal of Electrical Electronics & Computer Science Engineering Volume 4, Issue 4 (August, 2017).
[117] Baimel, D, 2016, Smart Grid Communication Technologies, Journal of Power and Energy Engineering, 2016, 4, 1-8.
[118] https://www.comreg.ie/industry/radio-spectrum/licensing/search-licence-type/telemetry/
[119] ETSI, 'Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements', ETSI TR 103 401 V1.1.1 (2016-11).
[120] ECC Report 292, Current Use, Future Opportunities and Guidance to Administrations for the 400 MHz PMR/PAMR frequencies.
[121] Baimel, D, 2016, Smart Grid Communication Technologies, Journal of Power and Energy Engineering, 2016, 4, 1-8.

requirements for utility networks, as listed by Plum and CEPT and including, in particular, mission critical communications[122]. ETSI[123] has noted that public mobile networks would need appropriate resilience and power backup measures before they could be deemed suitable for utility networks. CEPT is of the view[124] that commercial 3GPP systems[125] are unlikely to be appropriate for Smart Grids because they are less suited to utilities' mission critical control systems, where rapid and dynamic interactivity is required.

3.49 Mobile networks are unlikely to provide sufficient geographic coverage, resilience, reliability or latency and they would not be Smart Grid dedicated networks[126]. As noted by Plum, if there is a need to shut down network elements (for example, transformers) due to conditions such as overload, delays of milliseconds can be serious, hence network availability, reliability and resilience are essential[127]. ETSI further notes that it is essential that utility systems are self-managed so as to maintain and ensure coverage, latency and power backup[128]. ComReg's view on each is set out below:

[122] CEPT define mission critical utilities as transmission/distribution monitoring and control systems which need very rapid dynamic interactivity and extremely high reliability and security capable of operating for many days without power in harsh environments but with far fewer points of interactivity and again with relatively small data volumes.
[123] ETSI TR 103 401 Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements Note 3.
[124] CEPT contribution on Report ITU-R SM2351-2 - approved WGFM#91 - 14-18 May 2018 - https://cept.org/Documents/fm-54/41892/temp1_draft-revised-cept-contribution-for-report-sm-2351-2
[125] 3rd Generation Partnership Project (3GPP) is a collaborative project caters to a large majority of the telecommunications networks in the world. It is the standard body behind UMTS (Universal Mobile Telecommunications System), which is the 3G upgrade of GSM. The 3GPP technologies from these groups are constantly evolving through Generations of commercial cellular / mobile systems (see table below). Since the completion of the first LTE and the Evolved Packet Core specifications, 3GPP has become the focal point for mobile systems beyond 3G.
[126] Baimel, D, 2016, Smart Grid Communication Technologies, Journal of Power and Energy Engineering, 2016, 4, 1-8.
[127] For example, ESB noted that "*Smart Grid requires almost instantaneous communications with certain applications, extremely high availability of telecommunications channel, and coverage from designated base station as well as robust cybersecurity*". ComReg Document 17/105s.
[128] ETSI TR 103 401 Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements.

- Geographic Coverage (99.999%) – mobile networks provide population coverage in the high 90% range but geographic coverage is typically lower and more remote areas with low population densities - where renewable energy sources like wind farms are typically located – tend not to be covered or at least are not covered to the required extent. Commercial 3GPP networks are targeted to cover population centres. In general, they cannot be expected to serve isolated low populated or unpopulated areas across which utility supplies must frequently be carried and controlled[129];

- Resilience – While mobile networks are typically very resilient, service interruptions do occur as a result of extreme weather. All mobile operators reported network failures to ComReg during Storm Emma and Ophelia and mobile operators have made consumers aware of such issues. For example, Eir[130] and Vodafone[131] have experienced service interruptions during extreme weather. Smart Grid networks must be resilient to short term link breaks and power outages, not typical in commercial networks where, for example, base stations are not usually provided with multi-day battery backed up power facilities[132];

- Reliability – Reliability can generally be measured in terms of frequency and duration of network outages, the number of disturbances due to poor power quality, and the extent to which widespread blackouts have been eliminated. While mobile networks have proven very reliable they do fail on occasion, for various reasons. For example, eir[133], Three[134] and Vodafone[136] have all experienced network failures unrelated to extreme weather. The potential for network interruptions is recognised in licence conditions - licensees are subject to the minimum "Availability of the Network" Standard[137]; and

[129] CEPT updates to ITU - 'Smart grid utility management systems' Report, p21.
[130] https://www.rte.ie/news/business/2018/0302/944570-eir-reporting-service-interruptions-due-to-weather/
[131] http://www.thejournal.ie/vodafone-storm-1316479-Feb2014/
[132] CEPT updates to ITU - 'Smart grid utility management systems' Report, p21.
[133] https://www.rte.ie/news/2015/0902/725168-eircom-fault/
[134] http://www.thejournal.ie/mobile-phone-networks-are-having-problems-2032568-Apr2015/
[135] https://www.rte.ie/news/ireland/2019/0613/1055207-vodafone/
[136] http://www.thejournal.ie/vodafone-network-down-4124400-Jul2018/
[137] The Licensee shall ensure that network unavailability is less than 35 minutes (based on the weighting factors set out License) per six month period.

- Latency – Latency requirements for Smart Grids vary but are at a maximum of 10 ms to maintain stability but can be as low as 1 ms in the control of electricity sub-stations[138]. As noted by Plum, existing mobile networks currently are unable to meet these requirements, with 4G networks having minimum latencies of around 30 ms.

3.50 Plum is of the view that while certain aspects of a Smart Grid could be supported on a mobile network, there is strong rationale for a dedicated network because:

- mobile networks may not be able to meet the availability and reliability requirements - in particular they may fail when the mains power fails which is precisely when Smart Grid networks are most needed;
- mobile networks may not have coverage in areas where Smart Grid elements such as remote sub-stations and wind farms are located and operators may have little incentive to provide such coverage;
- despite new concepts such as network slicing, mobile networks may have insufficient capacity or there may not be a clear business model to give the appropriate prioritisation to Smart Grid control messages; and
- the benefits of using commercial networks are smaller for Smart Grids than public safety[139] as there is little need for handsets which benefit substantially from commercial economies of scale.

3.51 These views are consistent with those of EirGird and at least one Network Utility Operator (ESBN) who both consider that a public mobile network may not be appropriate for the provision of Smart Grid[140].

3.52 In light of the above, ComReg's final view is that:

a) there are no alternative unassigned frequencies to provide Smart Grid in Ireland;

b) there are no alternative technologies to provide Smart Grid in Ireland; and

c) use of existing mobile networks would not be suitable to provide for the likely requirements of Smart Grid as described by Plum and CEPT.

[138] The JRC in the UK has indicated that for some of the critical applications, particularly with transformers, 0.25 the cycle time (that is, 5ms) might be typical.
[139] In the UK, emergency services have opted to move to mobile using EE's LTE network and US public safety organisations are following a similar approach – Document 19/23a Plum Report - Potential use of the 400 MHz band in Ireland.
[140] ComReg Document 19/23s – Non-Confidential Submissions to ComReg Document 18/92 on the Proposed Release of the 410 – 414 MHz / 420 – 424 MHz sub-band – Published March 2019.

3.53 ComReg remains of the view that the primary policy issue to consider in assigning rights of use for 400 MHz Band is whether such rights should be assigned on a service neutral or service specific basis (that is, for Smart Grid use).

Objectives

3.54 This RIA assesses the impact of the proposed measure(s) on stakeholders, including consumers, and on competition. This should identify the most appropriate and effective means to assign the 400 MHz Band in an objective, transparent, and non-discriminatory manner while promoting the interests of end-users and the economic development of the electronic communications sector and the State.

3.55 ComReg seeks to design and conduct the process for assigning new rights of use in the 400 MHz Band in accordance with its statutory remit in managing spectrum. That remit, in summary, is to encourage the efficient use and ensure the effective management of spectrum, to promote competition in the electronic communications sector, to contribute to the development of the internal market, and to promote the interests of users within the Community. Please see Annex: 1 for a more detailed overview.

3.56 ComReg's goal, ultimately, is to choose the regulatory measure(s) which are most likely to maximise the benefits for consumers in terms of price, choice, and quality of products and services.

3.57 The remainder of this chapter contains the "**Assignment Process RIA**" – this addresses the primary policy issue and the statutory objectives outlined above.

Identify and describe the regulatory options (Step 2)

3.58 In light of the preceding discussion, and taking into consideration information provided in submissions in response to Document 17/67, Document 18/92 and Document 19/23, ComReg considers that the following three regulatory options are available to it.

Option 1 – Assign all rights of use to the 400 MHz Band on a service and technology neutral basis.

3.59 Under Option 1 the rights of use would be assigned on a service and technology neutral basis, allowing all bidders to compete for the same spectrum regardless of the intended use of those rights of use.

Option 2 – Limit all rights of use to the 400 MHz Band for the provision of Smart Grid.

3.60 Under Option 2 all rights of use (2 × 4 MHz) to the 400 MHz Band would be limited to the provision of Smart Grid as defined by Plum[141]. The only valid bidders would be those designated or licensed to operate a utility network (electricity, gas and water) in Ireland.

3.61 Bidders would require a licence issued by the Commission for Regulation of Utilities ("CRU") to distribute electricity, gas and/or water through a utility network. ComReg understands that the current network licence holders are: ESB Networks (electricity distribution network operator and owner), EirGrid (electricity transmission network operator), and Gas Networks Ireland[142] (gas network owner and operator)[143].

3.62 The definition of a "Network Utility Operator" that ComReg will use for the purpose of this award is:

- **in the electricity sector-**
  A person that has been granted a licence by the Commission for Regulation of Utilities under section 14 of the Electricity Regulation Act 1999, as amended:
  - *to discharge the functions of the transmission system owner;*
  - *to discharge the functions of the transmission system operator;*
  - *to discharge the functions of distribution System Owner;*
  - *to discharge the functions of the distribution system operator.*
- **in the gas sector-**
  The company or a subsidiary of the company, the functions of which are laid out in section 8 of the Gas Act 1976 and in section 11 of the Gas (Interim) (Regulation) Act 2002; and
- **in the water sector-**
  The private company limited by shares formed by virtue of section 4 of the Water Services Act 2013 as amended.

3.63 Alternatively, Option 2 could proceed in the same manner as Option 1. If no applications are received then a full service and technology neutral award would be held for the entire 2 × 4 MHz.

Option 3 – Limit some rights of use for the provision of Smart Grid and the remainder on a service and technology neutral basis.

[141] See para 3.20 of this document.
[142] Gas Networks Ireland is a subsidiary of Ervia. Ervia is a commercial semi-state company with responsibility for the delivery of gas and water infrastructure and services in Ireland.
[143] https://www.cru.ie/professional/energy/energy-networks/

3.64 Under Option 3, the available rights of use would be divided into two parts (Part A and Part B). Part A would be comprised of 2 × 3 MHz whose rights of use would be limited to Network Utility Operators as described in Option 2.

3.65 Part B would comprise the remaining 2 × 1 MHz whose rights of use would be available on a service and technology neutral basis as described under Option 1.

3.66 Alternatively, Option 3 could proceed in the same manner as Option 1. If no applications are received for Part A (2 × 3 MHz) then a full service and technology neutral award would be held for the full 2 × 4 MHz as would be the case under Option 1.

Identification of stakeholders

3.67 Step 3 assesses the likely impact of the proposed regulatory measures on stakeholders. Hence a necessary precursor is to identify such stakeholders who, in this RIA, fall into two main groups:

i. Consumers (Impact on consumers is considered separately below); and

ii. Industry stakeholders.

3.68 There are a number of key industry stakeholders in relation to the matters considered in this chapter. These are:

- Network Utility Operators (i.e. the Electricity, Gas and Water sectors);
- Mobile Network Operators (“MNOs”); and
- Other Service Operators (for example, providers of PMR, PPDR and TETRA/TEDS[144], Narrowband Internet of Things (“NB-IoT”) etc.).

Impact on stakeholders (Step 3)

3.69 It is recognised that, to the extent that a stakeholder has submitted a proposal in response to Document 17/67, Document 18/92 or Document 19/23, they are likely to prefer the option that most closely reflects that proposal. Otherwise, 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).

Network Utility Operators

3.70 ComReg notes the views of ESBN that a minimum of 2 × 3 MHz is necessary to provide for the provision of Smart Grid. In its submission to Document 18/92,

[144] See Section 3 of the Plum Report - ComReg Document 19/23a.

ESBN notes its preference for Option 2, reserving all available spectrum for Smart Grid. ESBN notes that reserving all available spectrum could serve to future proof a Smart Grid network.

3.71 As noted in the Plum report, applications such as video surveillance of key installations may be introduced in the future requiring access to the full spectrum available. Option 2 would allow a Network Utility Operator to obtain access to additional rights of use to support such uses that may arise in the future.

3.72 While ESBN has a preference for Option 2, it observed that Option 3 is most likely to meet ComReg's objectives. ESBN outlined a strong preference for Option 3 over Option 1, as Option 3 would still reserve a sufficient portion of spectrum (2 × 3 MHz) for Smart Grid. In its response to Document 19/23, ESBN agreed that Option 3 best meets ComReg's objectives of reserving 2 × 3 MHz for Smart Grid, whilst enabling the market to determine the optimum winner of the remaining spectrum. In response to Document 18/92, EirGrid also welcomed the proposal to allocate 2 × 3 MHz of spectrum in the 400 MHz Band specifically for Smart Grid services, which indicates support for Option 2 or Option 3.

3.73 From the point of view of a Network Utility Operator, Option 2 has an advantage over Option 3 in that it reserves all available spectrum for Smart Grid. However, Option 3 may provide Network Utility Operators a degree of choice not available under Option 2. Under both Option 2 and Option 3, a Network Utility Operator would have the ability to bid on rights of use in the remaining 2 × 1 MHz. Under Option 2, this additional spectrum would need to be used for Smart Grid. However, under Option 3, Network Utility Operators may also use the remaining 2 × 1 MHz for alternative uses, such as Smart Metering or PMR type services, if they so wish. This may be preferred by certain Network Utility Operators who wish to be assigned rights of use for the provision of Smart Grid (2 × 3 MHz) and other alternative uses such as Smart Metering.

3.74 Option 1 is the least preferred option for Network Utility Operators. Under Option 1 there is no certainty that such a provider would be assigned its preferred quantum of spectrum necessary for the provision of Smart Grid. Under Option 1, and in light of the findings of the Plum report, there is a risk that Network Utility Operators could be denied an essential input to the provision of Smart Grid for which no alternative frequencies are available. Such operators would have to operate their networks using existing telemetry systems or over mobile networks, which, as previously noted, is not conducive to the effective operation of a Smart Grid and in particular mission critical activities.

MNOs

3.75 MNOs are likely to prefer Option 1 over Options 2 and 3 as all available spectrum is contestable and would not restrict potential bidders from competing

for all available spectrum. While mobile services are unlikely to be provided as a result of the assignment of 400 MHz Band rights of use, MNO's nonetheless may be interested in those rights of use to complement existing rights of use currently providing NB-IoT type services, noting that the Plum report outlined that alternative uses of spectrum may be suitable for NB-IoT.

3.76 There are already multiple general-purpose IoT networks in Ireland including NB-IoT and Sigfox[145] as well as some LoRa deployments[146]. In that regard, MNOs have adopted new networks for specific uses such as Low Power Wide Area Networks ("LPWAN") specifically to support NB-IoT devices. Vodafone activated an NB-IoT network in August 2017[147]. Such technologies are also available for deployment in licence-exempt spectrum, meaning that end-users can deploy their own IoT network.

3.77 MNOs would likely prefer Option 3 over Option 2 as this provides an opportunity for the assignment of some 400 MHz Band rights of use. However, for an MNO only 2 × 1 MHz would be available in Part B under Option 3 which is less than the minimum bandwidth required for LTE use (1.4 MHz is the minimum LTE bandwidth). MNOs may be indifferent between Options 2 and 3, given that LTE equipment for the 410 – 430 MHz will likely be FDD and use a minimum bandwidth of 3 MHz (that is, a total of 2 × 3 MHz)[148]. ComReg retains its view that MNOs would likely prefer Option 1 and notes that no submissions were received from MNOs in response to Document 18/92 or Document 19/23.

Other Operators/Users

3.78 Other operators (PMR uses, PPDR and Smart Metering) would likely prefer Option 1 over Option 2 as all available spectrum is contestable and would not restrict certain potential bidders from competing for all available spectrum. However, such operators may also prefer Option 3 over Option 1 because 2 × 1 MHz is available on a service and technology neutral basis and other potential competing operators such as MNOs may be less likely to compete for that portion of the band given the lack of a 2 × 3 or 2 × 1.4 MHz block. While the minimum bandwidth for LTE is 1.4 MHz, there is little or no equipment available for that bandwidth in any of the LTE bands. As a result, the expectation is the minimum bandwidth will be 3 MHz. In any case, 2 × 1 MHz is less than the minimum bandwidth required for LTE[149]. Therefore, ComReg is of the view that

[145] For example, VT have deployed a Sigfox network and claim this can be used for Smart Metering. VT is the exclusive operator of the SIGFOX network in Ireland.
[146] https://www.semtech.com/company/press/Semtech-LoRa-Technology-to-Enable-Irelands-Nationwide-IoT-Network
[147] http://www.vodafone.com/business/news-and-insights/press-release/vodafone-is-first-to-announce-nb-iot-launch-markets
[148] See Section 4 of the Plum Report – ComReg Document 19/23a.
[149] Plum Report – ComReg Document 19/23a, p26.

other operators/users would prefer either Options 2 or 3 but notes that no submissions were received from other operators/users.

Impact on competition (Step 4)

3.79 Plum is of the view that it is very unlikely that MNOs would be interested in deploying a general-purpose network in the 400 MHz Band. While the 400 MHz Band is low in frequency and has good propagation characteristics suitable for coverage, there are no mobile handsets compatible with the 400 MHz Band and coverage gains can only be realised if efficient antennas can be deployed on terminal devices[150]. Therefore, the assignment of 400 MHz Band rights of use does not impact the provision of existing or future mobile services. As a result, under all options, competition in downstream mobile markets would not likely be affected.

3.80 Under Option 1, there is a risk that rights of use could be assigned to bidders other than a Network Utility Operator. Under these circumstances, one of two scenarios is likely to arise:

a) The winning bidder would use the spectrum rights of use for uses other than Smart Grid, thereby foreclosing spectrum rights of use for the provision of Smart Grid; or

b) The winning bidder would use the spectrum rights of use to provide Network Utility Operators with access to a communications network to enable them manage their Smart Grids.

3.81 In relation to (a), Network Utility Operator(s) would have no alternative frequencies or solutions suitable to satisfy the technical requirements as described above. Network Utility Operators would have to rely on other sub-optimal alternatives such as existing telemetry systems or mobile networks. Indeed, by foreclosing rights of use to Network Utility Operators for the provision of Smart Grid, MNOs may strategically or inadvertently compel Network Utility Operators to use mobile networks as a sub-optimal alternative in order to, at a minimum, improve on existing telemetry systems. As previously discussed, these alternatives would seem unlikely to provide for an effective Smart Grid solution and the benefits of same (increased efficiencies, reduced cost, reduced CO_2 emissions)[151] would not be realised to the same extent. In effect, under this

[150] At 400 MHz the optimal passive half-wave dipole antenna is around 35cm this is larger than most mobile handsets so if the band were used for mobile the reduced antenna size would likely nullify the propagation gains over frequencies such as 800 MHz.
[151] See Impact on Consumers below.

scenario, Smart Grid as set out above could be significantly impaired with the existing grid unable to realise many of these benefits[152].

3.82 In relation to (b), a winning bidder may be able to offer access to a communications network to enable a Smart Grid using the 400 MHz Band and potentially other rights of use (for example, the 800 and 900 MHz bands). Alternatively, rights of use could be leased or traded to the Network Utility Operator to operate a communications network for the Smart Grid in its own right. However, this would likely lead to a negative impact on competition as rights of use to an essential input would be invested in a single provider (only one block of 2 × 3 MHz is available) who would not be utilising the Smart Grid but rather providing network access or rights of use to a Network Utility Operator.

3.83 In effect, such an entity could become the sole provider of spectrum rights of use for the provision of access to a Smart Grid communications network. As noted by DotEcon, this would distort any auction, as there would effectively be competition to secure the position of sole provider and spectrum prices could be artificially inflated by competition for monopoly rents. DotEcon also notes that such an outcome would be contrary to the objective of ensuring an efficient assignment and use of the radio spectrum.

3.84 Further, the provision of access to this communications network using the 400 MHz Band rights of use would likely be at a rate above the cost incurred by that entity during the award process. By extension, this would also be above the value expressed by the Network Utility Operators during the award process. In effect, a Network Utility Operator would likely have to pay a premium above the market clearing rate determined by the award process, potentially eroding any efficiency gains that may be accrued from the provision of a Smart Grid in the first instance.

3.85 For similar reasons, such an approach is also not recommended by ETSI in the provision of Smart Grid who notes that "Ideally, the 400 MHz UHF/VHF spectrum for the Utility Operation Networks (UON) will be self-owned/self-managed so as to ensure that the required resilience, quality of service (QoS), etc., are maintained and, especially, the cost of operation is kept similar to existing costs. Some utility operations may consider allowing a third-party to supply the necessary communications so long as the spectrum remains under the control of the utility."[153] [Emphasis added].

3.86 Alternatively, under Option 2, 2 × 4 MHz rights of use would be limited to Smart Grid use. Each Network Utility Operator would have the opportunity to be

[152] Xi Fang et al. 2012 Smart Grid – The new and Improved Power Grid: A Survey – IEEE Communications Surveys & Tutorials.
[153] ETSI, 'Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements', ETSI TR 103 401 V1.1.1 (2016-11).

assigned rights of use for the provision of Smart Grid whose use could not be foreclosed and spectrum rights of use would not be a barrier to the provision of Smart Grid, compared to Option 1. However, under Option 2, 2 × 4 MHz would likely be assigned to a Network Utility Operator for Smart Grid when 2 × 3 may have been sufficient and the remaining 2 × 1 MHz would be assigned to Smart Grid as a result of the restriction rather than a requirement of same. While alternative spectrum is available for other uses (for example, PMR), an unreasonable restriction of an additional 2 × 1 MHz for Smart Grid could deny other uses additional spectrum that would likely improve competition in those markets.

3.87 Under Option 3, 2 × 3 MHz rights of use would be limited to Smart Grid in line with the amount of spectrum necessary for the efficient operation of a Smart Grid. Each Network Utility Operator would have the opportunity to be assigned rights of use for the provision of Smart Grid whose use could not be foreclosed and spectrum rights of use would not be a barrier to the provision of Smart Grid compared to Option 1. Finally, under Option 3, as noted by DotEcon, any winning bidder of the 2 × 3 MHz portion could find it difficult to justify denying any remaining Network Utility Operators a reasonable and necessary request to access the Smart Grid and/or associated spectrum rights because the winning bidder would be subject to ex-post competition law obligations, noting that there are currently no alternative frequencies available for the provision of Smart Grid.

3.88 Therefore, ComReg's final view is that Option 3 provides for the best opportunity to promote competition for the following reasons:

- it would prevent foreclosure of an essential input for Smart Grids by providing Network Utility Operators with an opportunity to be assigned the amount of spectrum rights of use necessary to efficiently operate a Smart Grid;

- it would release the remaining spectrum rights of use (2 × 1 MHz) on a service and technology neutral basis allowing other uses access to additional spectrum notwithstanding the availability of suitable alternatives in other bands;

- the possibility of a subsequent ex-post competition complaint by an alternative Network Utility Operator against the winning bidder should provide a sufficient restraint on the winning bidder denying reasonable access;

- it would likely prevent any Network Utility Operator from leveraging its position as sole licensee of an essential input as the winning bidder would be subject to ex-post competition law obligations;

- it would avoid outcomes where spectrum goes unsold despite efficient demand existing for that spectrum (i.e. the auction would be sequenced such that demand for Smart Grid would be assessed first); and

- the award would promote incentives for bidders not to engage in strategic or collusive behaviour.

3.89 Therefore, and for the reasons stated above, Option 3 would, in ComReg's view, better promote competition.

Impact on consumers (Step 5)

3.90 ComReg considers that consumers would prefer the regulatory option which does not impact its existing use of mobile services and has the greatest potential to promote efficient energy technologies while increasing consumer welfare, thereby maximising the long term benefits to consumers in terms of price and quality in the provision of mobile and non-mobile services. Consumers are also likely to prefer options which can avoid or reduce disruptions to the services they currently use.

3.91 As noted in the 'Impact on competition' section above, 400 MHz Band rights of use are not suitable for the provision of mobile services. Therefore, for all options there is no consumer impact in the provision of mobile services. As a result, consumers are likely to be concerned about the provision of services resulting from the use cases considered suitable in the Plum report (i.e. PMR, PPDR, Smart Metering and Smart Grid) and the related end-uses provided by those networks (for example, energy and other utilities). Further, the provision of 2 × 1 MHz on a service and technology neutral basis provides rights of use for other uses identified by Plum noting that such uses also have other alternative spectrum rights of use.

3.92 In relation to Option 1, consumers may be indifferent about the assignment of rights of use to a particular user given that the provision of mobile services are unlikely to be affected. However, under Option 1, and given the multiple likely uses of the band, there is a possibility that the assignment of rights of use for the provision of one type of use could exclude the provision of other use types. In particular, the possibility for deployment of a Smart Grid network in Ireland would likely be removed if more than 2 × 1 MHz were assigned to users for the provision of other services (such as PMR or NB-IoT). This situation would not arise for any other use type since, as noted by Plum, all other potential uses (that is, PMR, PPDR and Smart Metering) have alternative frequencies on which to operate or alternative solutions to provide for those services. Smart Grid is the only use case that does not have suitable alternative frequencies or solutions.

3.93 In that regard, it is worth considering what consumer benefits would arise from the provision of Smart Grid which could be denied under Option 1. ComReg assesses the benefits of a Smart Grid for the electricity network below noting that similar benefits are available for other utility providers. In that regard, consumer benefits from Smart Grid use can be broadly divided into three areas:

a) Reduced losses and inconvenience to consumers from power outages and power quality issues. For example, there was a total of 35,859[154] power outages occurred across the country in 2015[155];

b) Downward pressure on energy prices (gas and electricity) through improved operating efficiencies arising from use of Smart Grid; and

c) Increased use of renewable energies and reduced carbon emissions.

3.94 In relation to (a), Smart Grid systems are designed to detect power quality issues and loss of power, enabling system operators to rapidly diagnose system problems, preventing outages from occurring and more rapidly restore service when they occur. For example:

- Demand response systems can reduce the stress on system assets during peak conditions, reducing their probability of failure[156] [157];
- Sensors and intelligent controls provide operators with increased awareness of the network allowing early detection of failing equipment[158] allowing predictive condition-based maintenance[159]; and
- Smart Grid can quickly isolate system problems and location of outages, reducing outage duration and restore itself after a blackout[160], thereby limiting the number of customers affected[161].

3.95 In relation to (b) 'operating efficiencies' from Smart Grids can occur in a number of ways including:

- reduced use of inefficient generation to meet system peaks. Usually the most costly and inefficient generation occurs during peak periods[162]. Demand for electricity is not constant and the cost to meet these different demands varies. This requires a buffer of excess power in the

[154] This excludes outages due to storms, outages that lasted less than 3 minutes and those caused by problems in the transmission system.
[155] Latest ESB Performance Report - 2015.
[156] Momoh, J, 2012, Smart Grid Fundamentals of Design and analysis, p23.
[157] US Department of Energy, Understanding the Benefits of the Smart Grid, 2010.
[158] US Department of Energy, Understanding the Benefits of the Smart Grid, 2010.
[159] Bangalore, P & Tjernberg, L (2016) Condition Monitoring and Asset Management in the Smart Grid.
[160] Xiao, Y, Communications and Networking in a Smart Grid, p5.
[161] Borlase, S, 2017, Smart Grids: Infrastructure, Technology, and Solutions, p406.
[162] Smart Grid Handbook, 3 Volume Set, Volume 1, p16.

existing grid. This causes higher emissions, higher costs and lower efficiency[163], ultimately impacting on consumers;

- improved efficiency removes or reduces the need for capacity expansion or upgrades and the associated costs of same[164]; and
- reduced transmission congestion costs[165] through the use of Smart Grid technologies can translate into significant savings.

3.96 In relation to (c), consumers are also likely to prefer options that promote increased use of renewable energy, particularly where such options do not require actions by consumer's themselves[166]. For example, 7 in 10 residential electricity customers believe it important that energy is produced from renewable resources[167] [168]. Further, 88% of Irish consumers agree that fighting climate change and using energy more efficiently can boost the economy and jobs[169].

3.97 In that regard, Smart Grid systems are needed in order to intelligently manage renewable energy such as solar and wind. Intelligence in sub-stations will enable control and data acquisition systems to more effectively manage power supply and demand in grid segments that contain renewable energy sources. Smart Grid technologies enable high levels of renewables mainly by increasing grid flexibility and facilitating the increased use of variable renewable generation technologies. Further, in the medium to long term, the provision of Smart Grid systems provides the opportunity for certain consumers to sell consumer-produced renewables back to the grid.

3.98 Operating efficiencies and a more intelligent grid network leads to a more reliable grid, reducing power outages and keeping downward pressure on electricity prices. Further, these benefits are obtained while also increasing access to renewable energies and reducing carbon emissions. Consumers are therefore likely to prefer the assignment of radio spectrum that promotes such efficiencies.

3.99 In light of the above, ComReg remains of the view that consumers are unlikely to prefer Option 1 as the benefits of Smart Grid outlined above may not arise.

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[163] Ramana, V & Manoj, S, 2017, Smart Grid an optimal solution to economic and environmental benefits. International Journal of Electrical Electronics & Computer Science Engineering Volume 4, Issue 4 (August, 2017).
[164] Smart Grid Handbook, 3 Volume Set, Volume 1, p16.
[165] Transmission congestion costs arise from the fact that, when transmission lines represent a bottleneck, it is not possible to generate electricity from the cheapest sources.
[166] In that regard, it is ComReg's understanding that much of the benefits of a Smart Grid relate to the transmission network and can be obtained absent consumer action on Smart Meters.
[167] CRU Annual Survey of Residential and SME Customers in the Gas and Electricity Markets in Ireland, December 2017.
[168] In particular, it would appear that Smart Grid can deliver certain benefits absent full engagement of smart meters. Much of the gains from Smart Grid in terms increased access to renewable energies are independent from Smart Meters.
[169] Special Eurobarometer 459, Climate Change, September 2017.

Option 2 would likely be preferred to Option 1 as this provides Network Utility Operators with the opportunity to obtain spectrum rights of use in the provision of a Smart Grid. However, the assignment of 2 × 4 MHz would likely be in excess of the spectrum requirements of Smart Grid and the remaining 2 × 1 MHz may be better served for other alternative uses as outlined in the Plum report. In that regard, Option 3 best provides for the provision of the Smart Grid while also ensuring other uses are also provided with 400 MHz Band rights of use where required.

3.100 Therefore, ComReg's final view is that consumers are likely to prefer Option 3.

Preferred Option (Step 5)

3.101 The above assessment considers the likely impact of all valid regulatory options from the perspective of industry stakeholders and considering the likely impacts of all options on competition and consumers. In summary, ComReg considers that MNOs and to a lesser extent other potential users would likely prefer Option 1 in which all rights of use are assigned on a service and technology neutral basis. Alternatively, Network Utility Operators are likely to prefer Option 2. Network Utility Operators could potentially prefer Option 3, if they wish to be assigned additional rights of use for the provision of Smart Grid (2 × 3 MHz) and other alternative uses, such as Smart Metering. ComReg considers that while Option 1 and Option 2 might be in the best interests of particular stakeholders, however, neither is likely to be preferable to Option 3 in terms of promoting competition.

3.102 Option 3, in this case, appears to be the best means to promote competition for spectrum usage rights and, in turn, promote competition in the related markets. Further, consumers are likely to prefer Option 3 as it provides a range of benefits across different potential uses of the radio spectrum. This approach allows an essential input in the provision of Smart Grid to be provided for where there are no alternative frequencies available to Network Utility Operators. DotEcon also recommends that it is likely to be efficient for at least part of the band (2 × 3 MHz) to be used for Smart Grid given that there is no alternative spectrum available to support such a use. Therefore, for the reasons set out in this RIA, ComReg's final view is that Option 3, to limit some rights of use (2 × 3 MHz) for the provision of Smart Grid and award the remainder on a service and technology neutral basis, is its preferred option[170].

[170] ComReg is also of the view that the new rights of use should be assigned by auction. Chapter 4 considers different auction formats and identifies a "Simple Clock Auction" (SCA) as preferable in the assignment of all rights of use.

3.103 In forming this view, ComReg is aware that a key principle to the management of radio frequencies under the Regulatory Framework is service and technology-neutrality[171]. This principle is reflected in ComReg's obligations under the Framework Regulations[172], the RSPP Decision[173] and the 2002 Act, as amended[174]. Despite this overarching principle, restrictions may be imposed on the types of services and/or technologies that may be provided or deployed in a specific band, though any such restrictions must be justified, proportionate, transparent, and non-discriminatory in order to fulfil certain relevant objectives, including to safeguard the efficient use of spectrum[175] and when general interest objectives are at stake[176].

3.104 ComReg considers its 'Preferred Option' is justified and proportionate for the reasons set out in the RIA above, and in summary include:

- there is likely a key requirement for Smart Grid as evidenced by the various national and international policy targets to reduce carbon emissions and make the energy system more secure and sustainable, all of which include the provision of Smart Grids (see paras 3.23 – 3.34);

- suitable and sufficient alternative spectrum rights of use are not readily available in other bands. In that regard, ComReg notes that:

    - There are no alternative radio frequencies available for the use of Smart Grid. The 450 – 470 MHz band is the only other sub 1 GHz spectrum that is suitable for the provision of Smart Grid and is currently assigned for PMR (Business Radio) and is therefore unavailable (see paras 3.35 – 3.41);
    - Alternative technical solutions such as existing telemetry systems and mobile networks are not effective or sufficient for the provision of Smart Grid and do not cater for the technical requirements of a Smart Grid as determined by Plum and CEPT (see paras 3.42 – 3.53);
    - ComReg's expert advisor Plum is of the view that there is no other suitable spectrum available in the medium term to meet the critical communications needs of Smart Grids compared with the situation for the other identified uses; and

[171] Recitals 32 and 34 of the 2009 Amending Directive.
[172] Regulations 16(1)(a), 17(2) and 17(4) of the Framework Regulations.
[173] Articles 2(1)(e), 2(2)(a), 3(f) and 6(3) of the RSPP Decision.
[174] Section 12(6) of 2002 Act, as amended.
[175] Regulation 17(5) of Framework Regulations; Articles 2(1)(e) of the RSPP Decision; Recital 38 of the 2009 Amending Directive; and Recitals 34 and 35 of the 2009 Amending Directive.
[176] Recital 34 of the 2009 Amending Directive.

  - The likely technologies that have been considered by Plum are likely to be varied for the different use cases (PMR, NB-IoT, LTE and TETRA) warranting a technology neutral approach.

- a service and technology neutral award could result in the assignment of rights of use to other uses foreclosing spectrum rights of use for the provision of Smart Grid;

- it would better ensure the efficient use of the radio spectrum by preventing speculative acquisition of 400 MHz rights of use in order to deny a Network Utility Operators those rights of use;

- the proposed restriction would only relate to the spectrum rights of use necessary to efficiently operate a Smart Grid (i.e. 2 × 3 MHz). The remaining 2 × 1 MHz would be made available on a service and technology neutral basis (see paras 3.39 – 3.41 and 3.58 – 3.66);

- the proposed restriction is being applied such that if there are no applications for the 2 × 3 MHz portion from applicable Network Utility Operators, the full 2 × 4 MHz would be released on a service and technology neutral basis (see para 3.58 – 3.66);

- ComReg has taken account of issues raised by responses to Document 17/105 by commissioning Plum to assess potential uses of the 400 MHz and the availability of alternative frequencies for same. In addition, Plum has provided further reports on responses received to Document 18/92 and Document 19/23;

- the views of DotEcon that this band is the only opportunity in the foreseeable future to establish a wireless Smart Grid network in Ireland; and

- there does not appear to be any less onerous means to address the likely requirement for spectrum rights of use in the provision of Smart Grid and to address the risk that those rights of use may not be assigned to a Network Utility Operator in a service and technology neutral award.

3.1 Assessment of preferred option against ComReg's statutory functions, objectives and duties

3.105 This RIA identifies and considers a number of options potentially available to ComReg, within the context of the RIA analytical framework as set out in ComReg's RIA Guidelines (impact on industry stakeholders, the impact on competition and the impact on consumers). This RIA also analyses the extent to which those various options would facilitate ComReg to meet its statutory

remit in managing the 400 MHz Band. This includes, in particular, analysing the extent to which the various options would promote competition and ensure that there is no distortion or restriction of competition in the electronic communications sector, whilst also encouraging efficient investment in infrastructure, promoting innovation, and ensuring the efficient use and effective management of the 400 MHz Band.

3.106 In this section, ComReg assesses the Preferred Option against the statutory provisions relating to spectrum management (see Annex: 1). Those provisions are not exhaustively set out herein. In summary, ComReg's statutory function is to manage the national radio spectrum resource and its objectives, in doing so, are to promote competition, to contribute to the development of the internal market, to promote the interests of users within the Community, and to ensure the efficient use and effective management of spectrum. ComReg is also required to take measures towards the achievement of its objectives but must also have regard to certain regulatory principles. Specifically, its measures must be justified, transparent, non-discriminatory, and proportionate.

Promotion of Competition

3.107 One of ComReg's statutory objectives, set out in section 12 of the 2002 Act, as amended, is to promote competition 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; and
- ensuring that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality.

3.108 Other statutory provisions also require ComReg to promote and safeguard competition in the electronic communications sector:

- Regulation 16(2) of the Framework Regulations 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;
- Regulation 9(11) of the Authorisation Regulations requires ComReg to ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies; and

- Article 4 of Directive 2002/77/EC (Competition Directive) requires ComReg to refrain from granting exclusive or special rights of use of radio frequencies for the provision of electronic communications services;

3.109 ComReg remains of the view that the Preferred Option would best safeguard and promote competition. In particular, it should maximise competition by preventing the foreclosure of an essential input to the provision of Smart Grid (that is, 400 MHz Band rights of use). In identifying the Preferred Option, ComReg applied objective, transparent, non-discriminatory and proportionate criteria and principles.

3.110 ComReg also considers that the alternative options would not achieve its objectives concerning competition to the same extent as the Preferred Option. In particular, Option 1 could lead to the foreclosure of an essential input to the provision of Smart Grid and Option 2 goes beyond what is necessary to prevent the said foreclosure.

Contributing to the development of the Internal Market

3.111 ComReg considers the following factors to be particularly relevant to its statutory objective to contribute to the development of the Internal Market, in the context of this award process:

- The Preferred Option should best support the establishment and development of trans-European networks and the interoperability of pan-European services, in particular by facilitating, or at the very least by not distorting or restricting, entry into the Irish mobile market by undertakings from other EU Member States; and
- In selecting the Preferred Option, and in order to ensure the development of consistent regulatory practice and the consistent application of EU law, ComReg has had due regard to the views of the European Commission, BEREC and other EU Member States.

Encouraging the establishment and development of trans-European networks and the interoperability of pan-European Services

3.112 ComReg notes the overlap between this objective and the objective to promote competition. Encouraging the establishment and development of trans-European networks requires that operators from other Member States, who seek to develop such networks, are given a fair and reasonable opportunity to obtain and/or use all requisite spectrum. ComReg considers that any regulatory measure which failed to encourage (or which actively discourages) the

establishment and development of trans-European networks, would not meet the objective at issue.

3.113 ComReg, in this regard, considers that limiting rights of use to part of the 400 MHz Band for Smart Grid best encourages the establishment and development of trans-European networks. The European Commission's Trans-European Networks for Energy TEN-E Regulation has identified Smart Grid deployment as one of 12 trans-European energy infrastructure priority corridors and areas. Smart Grids feature on the Commission's list of projects of common interest (PCIs). PCIs are key energy infrastructure projects seen as essential to completing the EU's internal energy market.

3.114 The Integrated Single Electricity Market (I-SEM) is a new wholesale electricity market arrangement for Ireland and Northern Ireland. The new market arrangements are designed to integrate the all-island electricity market with European electricity markets, enabling the free flow of energy across borders. The market is run by the Single Electricity Market Operator (SEMO), a joint venture between EirGrid (electricity transmission operator)[177] and the System Operator for Northern Ireland (SONI). The new market arrangements are designed to integrate the all-island electricity market with European electricity markets, making optimal use of cross-border transmission assets[178].

Promoting the development of consistent regulatory practice and the consistent application of EU Law

3.115 ComReg continues to cooperate with other National Regulatory Authorities ("NRAs") and to closely monitor developments in other Member States, to ensure that its regulatory practice and implementation of the Common Regulatory Framework is generally consistent with comparable jurisdictions.

3.116 For example, ComReg has had regard to international developments in the use of the radio spectrum for the provision of Smart Grid, including the policy goals of the European Commission and technical standards as described by CEPT, ETSI and the ITU.

3.117 ComReg will continue to note relevant international developments including future updates to ITU-R SM.2351-2, as identified in the ITU and ETSI respective work plan.

Promote the interest of the users within the Community

3.118 The likely impact of the Preferred Option and of the other identified option on users, generally and in the context of ComReg's objective to promote

[177] EirGrid Group is the independent Transmission System Operator (TSO) in Ireland and Northern Ireland, through EirGrid and SONI, respectively.
[178] EirGrid - Quick Guide to the Integrated Single Electricity Market.

competition, has been considered earlier in this RIA and is not considered in any further detail in this section.

3.119 ComReg also observes that most of the measures set out in section 12(2) (c) of the 2002 Act, as amended, aimed at promoting the interests of users, relate to consumer protection more than to spectrum management. In that regard, ComReg has identified the likely consumer benefits arising from the Preferred Option.

Efficient use and effective management of spectrum

3.120 Section 10 of the 2002 Act, as amended, requires ComReg to manage spectrum in accordance with Ministerial Policy Direction No. 11 of 21 February 2003, issued under section 13 of the 2002 Act, as amended. Policy Direction No.11 requires ComReg to ensure that, in managing spectrum, it takes account of the interests of all users of spectrum, including commercial and non-commercial users. Also, in pursuing its objective to promote competition ComReg must take all reasonable measures to encourage efficient use and ensure effective management of spectrum.

3.121 Further, section 12(3) of the 2002 Act, as amended, also requires that all measures by ComReg, including any measure related to managing spectrum, be proportionate, and regulation 9(11) of the Authorisation Regulations requires ComReg to ensure that spectrum is used efficiently and effectively having regard to section 12(2)(a) of the 2002 Act, as amended, and regulations 16(1) and 17(1) of the Framework Regulations.

3.122 In relation to Policy Direction No.11, this RIA seeks to take into account the interests of all current and potential users of the 400 MHz Band, commercial and non-commercial. ComReg commissioned Plum to review all potential uses of the band in order to best inform ComReg's decision making on same. ComReg is of the view that the Preferred Option would best safeguard and promote those interests. Further, ComReg's expert economic advisors DotEcon also notes that it is likely to be efficient for at least part of the band to be used for Smart Grid and that an outcome which prevented this could be contrary to ComReg's objectives to ensure the efficient assignment and use of the radio spectrum.

3.123 Based on this RIA, ComReg remains of the view that the Preferred Option would best encourage the efficient use of the 400 MHz Band and, in particular, the portion of the 400 MHz Band in which new rights of use would be assigned. There is likely to be a continued reliance on a portion of the 400 MHz Band for Smart Grid into the future. If demand does not arise, a full service and technology neutral award would be conducted. Assignment of new 400 MHz Band rights of use for Smart Grid should provide certainty that a portion of the

400 MHz Band would be available for Smart Grid use for 15 years, at which point demand for the band and its potential uses can be considered afresh.

3.124 The Preferred Option also promotes effective management of the radio spectrum because there are no alternative frequencies available to provide for a Smart Grid.

3.125 ComReg's final view is that the Preferred Option best accords with its statutory objectives in managing the 400 MHz Band and that by pursuing any of the alternative options, ComReg would likely fail to meet some or all of its relevant statutory objectives.

Regulatory principles

3.126 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, as amended, 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;
- 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 principles of non-discrimination are preserved; and
- taking due account of the variety of conditions relating to competition and consumers that exist in the various geographic areas within a Member State.

Regulatory Predictability

3.127 ComReg generally has regard to the requirement for predictability in managing spectrum though this requirement must always be weighed against all relevant factors, some of which may necessitate measures which are less predictable or which are not predictable. ComReg has had regard to the requirement for predictability in its consideration of how best to reassign the 400 MHz Band, as illustrated below.

3.128 ComReg considers that regulatory predictability in relation to spectrum is best promoted by having an open, transparent, and non-discriminatory process for assigning new spectrum rights of use. In that regard, where ComReg is of the view that rights of use should be limited to a certain service or technology such restrictions must be justified, proportionate, transparent, and non-discriminatory

in order to fulfil certain relevant objectives. ComReg sets out in detail the reasons for limiting rights of use to a particular service for 400 MHz rights of use in the RIA. This approach is similar to that taken in the recent 26 GHz Spectrum Award in 2018 where a service restriction also applied and detailed justification for that restriction was provided[179].

3.129 ComReg notes that the Preferred Option would ensure that the future assignment of rights of use in the 400 MHz Band at issue would be known as soon as is possible. This should result in utmost transparency and predictability, in terms of interested parties being aware of the availability of 400 MHz rights of use in the future. ComReg maintains its view, as set out in Section 4.9 of Document 18/92, that any unsold lots would not be assigned for a reasonable period after the award process has ended.

3.130 ComReg remains of the view that the alternative options, would be unlikely to promote regulatory predictability as important use cases in the future that are clearly established (for example, Smart Grid in 400 MHz and National Fixed Links in 26 GHz) and have no viable alternative frequencies may be foreclosed.

3.131 In addition, ComReg remains of the view that the Preferred Option:

- should no demand from Network Utility Operators for spectrum rights of use for the provision of Smart Grid arise, all remaining rights of use should be made available on a service and technology neutral basis;
- has been justified based on the available evidence and views of Plum, CEPT, ETSI and the ITU; and
- remain technology neutral in line with the Plum report which identified a number of technologies that could be used to deliver a variety of use cases.

3.132 In light of the above, ComReg remains of the view that the Preferred Option, an auction, should best accord with the regulatory principle of promoting regulatory predictability.

Promoting efficient investment and innovation in New and Enhanced Infrastructures

3.133 ComReg remains of the view that the Preferred Option is consistent with this regulatory principle in that it should:

- facilitate a competitive release of a portion of the 400 MHz Band for Smart Grid at the earliest possible opportunity, thus ensuring that the winners of the new 400 MHz Band rights of use are appropriately incentivised to invest in new technologies and infrastructures;

[179] ComReg Document 18/53 – Results of the 26 GHz Spectrum Award 2018 – Published 19 June 2018.

- provide clarity as to whether demand for spectrum rights of use in the provision of Smart Grid exists in practice, and allows other services access to other spectrum rights of use (2 × 1 MHz) or additional rights of use (2 × 4 MHz) if demand for spectrum does not exist; and
- allows Network Utility Operators access to spectrum rights of use that are necessary in order to efficiently role out a Smart Grid, noting that investment in alternative solutions would lead to less efficient and less innovative outcomes.

General guiding principles (in terms of spectrum management, licence conditions and setting of licence fees)

3.134 ComReg is required to be objective, transparent, non-discriminatory, and proportionate in the exercise of its statutory functions under the Common Regulatory Framework.

3.135 In relation to spectrum management and use, ComReg notes that:

- Regulation 11(2) of the Authorisation Regulations requires ComReg to grants rights of use for radio frequencies on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate; and
- Regulation 16(2) of the Framework Regulations requires ComReg 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.

3.136 ComReg at all times seeks to take account of and act in accordance with the above guiding principles of Irish and EU law.

3.137 ComReg, having had regard to the applicable statutory provisions, its RIA and other analyses, the advice of its external consultants, and all other relevant material, is of the final view that the Preferred Option would be an objectively justified, transparent, proportionate and non-discriminatory regulatory measure by which to assign new rights of use in the 400 MHz Band for 15 years duration and for the purposes of deploying Smart Grid and/or other uses as determined by winning bidders.

Chapter 4

4 Decision Instrument

Decision Instrument

Introduction

1. Definitions and Interpretations

In this Decision Instrument, save where the context otherwise admits or requires:

"400 MHz Band" means the part of the radio frequency spectrum consisting of the 410 – 414 MHz / 420 – 424 MHz sub-band;

"**400 MHz Band Licence**" or "**Licence**" means a licence granted by ComReg pursuant to section 5 of the Wireless Telegraphy Act 1926 (as amended) and the 400 MHz Band Licence Regulations 2019, of the type set out in Schedule 1 to the 400 MHz Regulations 2019 and subject to the terms and conditions contained in the Licence and Schedule 2 of the 400 MHz Regulations 2019;

"**400 MHz Regulations 2019**" means the Wireless Telegraphy (400 MHz Band Licences) Regulations, 2019 (S.I. XX/2019) made by ComReg pursuant to section 6 of the Wireless Telegraphy Act 1926 with the consent of the Minister under section 37 of the Communications Regulation Act 2002, as amended, and as set out in the Information Memorandum;

"**Authorisation Regulations**" means the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations, 2011 (S.I. No. 335 of 2011);

"**Award Spectrum**" means the portion of the means the part of the radio frequency spectrum consisting of the 410 – 414 MHz / 420 – 424 MHz sub-band; the available rights of use of which will be divided into two parts (Part A and Part B): Part A is comprised of 2 × 3 MHz for the provision of wireless connectivity for Smart Grid whose rights of use would be limited to Network Utility Operators as set out in the Information Memorandum; and Part B is comprised of the remaining 2 × 1 MHz whose rights of use would be available as set out in the Information Memorandum; and which will be awarded by means of two sequential auctions;

"**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;

"Decision Instrument" means this Decision Instrument;

"**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 (the draft information memorandum has been published as ComReg Document 19/56);

"**Licensee**" means an undertaking to whom a 400 MHz Band Licence has been granted;

"**Minister**" means the Minister for Communications, Climate Action and Environment;

"**Network Utility Operator**" means:

- in the electricity sector –

(1) *A person that has been granted a licence by the Commission for Regulation of Utilities under section 14 of the Electricity Regulation Act 1999, as amended:*

- to discharge the functions of the transmission system owner;
- to discharge the functions of the transmission system operator;
- to discharge the functions of distribution System Owner;
- to discharge the functions of the distribution system operator;

- in the gas sector –

(2) *The company or a subsidiary of the company, the functions of which are laid out in section 8 of the Gas Act 1976 and in section 11 of the Gas (Interim) (Regulation) Act 2002; and*

- in the water sector –

(3) *The private company limited by shares formed by virtue of section 4 of the Water Services Act 2013 as amended.*

"Radiocommunication Services" means a service as defined in the Radio Regulations of the International Telecommunication Union involving the transmission, emission or reception of radio waves for specific telecommunication purposes.

"**RIA**" means Regulatory Impact Assessment;

"**Smart Grid**" means advanced delivery systems for utility services (electricity, gas and water) from sources of generation and production to key elements in the grid networks and includes all supervisory and control necessary for their effective management. For the avoidance of doubt, this definition does not

include the use of smart metering, which consists of devices located at premises that record energy, water and gas usage and provide two-way electronic communication between consumers and the grid;

"**Wireless Telegraphy Act 1926**" means the Wireless Telegraphy Act, 1926 (No. 45 of 1926), as amended.

2. Decision-Making Considerations

In arriving at its decisions as set out in this Decision Instrument, 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. Consultation on Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – ComReg Document 17/67;
b. Response to Consultation on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz Sub-band – ComReg Document 17/105;
c. Further Consultation on the release of the 410 – 415.5 / 420 – 425.5 MHz Sub-band– ComReg Document 18/92;
d. Response to Consultation and Draft Decision on the Release of the 400 MHz sub-band – ComReg Document 19/23;
e. Proposed 400 MHz Band Spectrum Award - Draft Information Memorandum and Draft Regulations – ComReg Document 19/56; and
f. Response to Consultation and Decision – ComReg Document 19/69.

(ii). the consultants' reports commissioned by ComReg and the advice obtained by ComReg in relation to the subject matter of the documents and materials listed at (i) above; and

(iii). the powers, functions, objectives and duties of ComReg, including, without limitation, those under and by virtue of:

a. the Communications Regulation Act 2002, as amended, and, in particular, sections 10, 12 and 13 thereof;

b. the Framework Regulations, and, in particular, Regulations 13, 16 and 17 thereof;

c. the Authorisation Regulations, and, in particular, Regulations 9, 10, 11, 12, 15, 16, 17, 18(1) and 19 thereof;

d. the Wireless Telegraphy Act, 1926 and, in particular, sections 5 and 6 thereof; and

e. applicable Policy Directions made by the Minister under section 13 of the Communications Regulation Act 2002.

In arriving at its decisions as set out in this Decision Instrument, ComReg has:

(i). given all interested parties the opportunity to express their views and to make submissions in accordance with Regulation 11 of the Authorisation Regulations and Regulation 12 of the Framework Regulations; and

(ii). 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 19/23 and their supporting annexes.

3. Decisions

ComReg has made the following decisions –

- ComReg will proceed with the release of the Award Spectrum using the auction format and in accordance with the procedures and rules as detailed in the Information Memorandum and will grant new 400 MHz Band Licences which shall come into operation on a date as specified by ComReg in accordance with the Information Memorandum.

- The available rights of use of the Award Spectrum will be divided into two parts (Part A and Part B): Part A is comprised of 2 × 3 MHz (410 – 413 MHz / 420 – 423 MHz) whose rights of use would be limited to Network Utility Operators as set out in the Regulations, and the Information Memorandum; and Part B is comprised of the remaining 2 × 1 MHz (413 – 414 MHz / 423 – 424 MHz) whose rights of use would be available as set out in the Information Memorandum.

- For the purpose of granting new 400 MHz Band Licences, and subject to obtaining the required consent of the Minister in accordance with section 37 of the Communications Regulation Act 2002, as amended, ComReg will make regulations under section 5 of the Wireless Telegraphy Act 1926, to be titled the Wireless Telegraphy (400 MHz Band Licences) Regulations 2019 and which shall prescribe, amongst other things –

  a. the form of such Licences;
  b. the period during which such Licences shall continue in force;
  c. the manner in which, the terms on which, and the period or periods for which such Licences may be renewed;
  d. the circumstances in which or the terms under which such Licences are granted;
  e. the circumstances and manner in which such Licences may be suspended or revoked;

f. the terms and conditions to be observed by the holders of such Licences and subject to which such Licences are deemed to be granted;
g. the fees to be paid on the application, grant or renewal of such Licences or classes of such Licences, subject to such exceptions as the appropriate authority may prescribe, and the time and manner at and in which such fees are to be paid; and
h. matters which such Licences do not entitle or authorise the holder to do.

- ComReg will attach certain conditions to the rights of use for radio frequencies that form the Award Spectrum, as generally described in Chapter 2 of the Information Memorandum and which will be further particularised in the Wireless Telegraphy (400 MHz Band Licences) Regulations 2019.

- All 400 MHz Band Licences will be of fifteen years duration such that they will commence concurrently on a date as ComReg may specify, and they will all expire concurrently on the fifteenth anniversary of such commencement date as may apply and all rights of use for radio frequencies assigned under such Licences shall commence and expire on the same dates as such Licences.

- 400 MHz Band Licences will permit Licensees who are Network Utility Operators to keep, possess, install, maintain, work and use apparatus for the provision of Smart Grids as defined in the Information Memorandum, on a national basis.

- 400 MHz Band Licences will also permit Licensees to keep, possess, install, maintain, work and use apparatus for the provision of Radiocommunication Services, on a national basis.

- 400 MHz Band Licences will permit Licensees to keep, possess, install, maintain, work and use equipment that utilises "Frequency Division Duplexing" technology only[180], and, in particular and for avoidance of doubt, Licences will not permit Licensees to keep, possess, install, maintain, work or use any form of equipment that utilises "Time Division Duplexing" technology[181].

- All undertakings who may be granted a 400 MHz Band Licence shall be selected by their participation in an open and competitive selection procedure, specifically two sequential auctions, using a "Simple Clock

[180] "Frequency Division Duplexing (FDD)" is a method for establishing a full-duplex communications link that uses two different radio frequencies for transmitter and receiver operation. The transmit direction and receive direction frequencies are separated by a defined frequency offset.
[181] "Time Division Duplexing (TDD)" is a method for emulating full-duplex communication over a half-duplex communication link. The transmitter and receiver both use the same frequency but transmit and receive traffic is switched in time.

Auction", the format, processes, and rules of which auctions are particularised in the Information Memorandum.

- The granting of a 400 MHz Band Licence, upon application, to any undertaking who successfully participates in the auction and wins some quantum of the Award Spectrum, shall be conditional upon all such undertakings paying the applicable fees for such Licences (as determined by the auction conducted in accordance with the Information Memorandum, and as set out in Schedule 2 of the 400 MHz Band Licences Regulations) and complying with the terms and conditions subject to which such Licences shall be deemed to be granted.

- To retain its discretion regarding how it might treat any unsold lots depending on the factual circumstances arising from the award process, save for the decisions that unsold lots will not be considered for assignment for a reasonable period after the process, and allocate any unsold lots in the upper end of the 400 MHz Band.

4. Statutory Powers Not Affected

Nothing in this Decision Instrument shall operate to limit ComReg in the exercise of its discretions or powers, or in the performance of its functions or duties, or in the attainment of any of its objectives under any laws applicable to ComReg from time to time.

Jeremy Godfrey

COMMISSIONER

THE COMMISSION FOR COMMUNICATIONS REGULATION

THE 27 DAY OF JUNE 2019

Chapter 5

5 Next Steps

5.1 Following public consultation of the draft Information Memorandum, Document 19/56, ComReg will, in due course, publish a response to draft Information Memorandum and a final Information Memorandum, and in doing so initiate the award process. The precise date of publication of the final Information Memorandum is subject to ComReg obtaining the consent of the Minister to the making by ComReg of the Wireless Telegraphy (400 MHz Band Licences) Regulations 2019.

5.2 Once the final Information Memorandum is published, ComReg will then facilitate the submission of questions regarding the award process and award rules and will respond publicly to these questions on an anonymous basis. The process for submission of questions will likely be set out in Section 3.3 of the Information Memorandum.

5.3 ComReg will process questions received within the stipulated period (as will likely be set out in Table 1 of the Information Memorandum). Questions and corresponding answers will be published concurrently on ComReg's website. ComReg will not reply directly to these questions.

5.4 In the interests of expediency, ComReg requires that any questions containing confidential material be accompanied by a redacted, non-confidential version of the question. Should a question that is considered confidential by its submitter not be accompanied by a redacted, non-confidential version, ComReg will not accept the question as being validly submitted, nor will ComReg publish the question on its website or address the matters raised therein.

5.5 In the event that ComReg receives correspondence on matters relating to this document, the Information Memorandum and the award process generally, ComReg hereby gives notice that it will publish all material correspondence received in this regard subject to the provisions of ComReg's guidelines on the treatment of Confidential Information.

Annex: 1 Legal Basis

A 1.1 The Communications Regulation Acts 2002-2017[182] (the "2002 Act"), the Common Regulatory Framework (including the Framework and Authorisation Directives[183] as transposed into Irish law by the corresponding Framework and Authorisation Regulations[184]), and the Wireless Telegraphy Acts 1926 to 2009[185] 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 preliminary consultation.

A 1.2 Apart from licencing 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.

[182] The Communications Regulation Act 2002, the Communications Regulation (Amendment) Act 2007, the Communications Regulation (Premium Rate Services and Electronic Communications Infrastructure) Act 2010, the Communications Regulation (Postal Services) Act 2011, the Communications Regulation (Postal Services) (Amendment) Act 2015, and the Communications Regulation (Postal Services) (Amendment) Act 2017.

[183] 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")

[184] 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.

[185] The Wireless Telegraphy Acts 1926 to 1988 and Sections 181 (1) to (7) and (9) and Section 182 of the Broadcasting Act 2009.

A 1.3 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 specific relevance to the matters at hand.

A 1.4 All references in this annex to enactments are to the enactment as amended at the date hereof, unless the context otherwise requires.

Primary Objectives and Regulatory Principles under the 2002 Act and Common Regulatory Framework

A 1.5 ComReg's primary objective in carrying out its statutory functions in the context of electronic communications are to:

- Promote competition[186]
- contribute to the development of the internal market[187]
- promote the interests of users within the Community[188];
- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under Section 13 of the 2002 Act;[189] 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

[186] Section 12 (1)(a)(i) of the 2002 Act.
[187] Section 12 (1)(a)(ii) of the 2002 Act.
[188] Section 12(1)(a)(iii) of the 2002 Act.
[189] 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.

regulations[190] in particular those designed to ensure effective competition[191]

Promotion of Competition

A 1.6 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 1.7 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 1.8 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. 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.

[190] 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).

[191] Regulation 16(1)(a) of the Framework Regulations.

Contributing to the Development of the Internal Market

A 1.9 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 electronic communications networks, electronic communications services 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 1.10 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.

Promotion of Interests of Users

A 1.11 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 electronic communications services
- 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 1.12 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.

Regulatory Principles

A 1.13 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 electronic communications networks and services;
- 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.

BEREC

A 1.14 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.

Other obligations under the 2002 Act

A 1.15 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[192];

- 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[193]; 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.[194]

[192] Section 12(3) of the 2002 Act.
[193] Section 12(5) of the 2002 Act.
[194] Section 12(6) of the 2002 Act.

Policy Directions

A 1.16 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.

Policy Direction No.4 on Industry Sustainability

A 1.17 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.

Policy Direction No.5 on Regulation where necessary

A 1.18 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 1.19 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 1.20 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 Management of the Radio Frequency Spectrum

A 1.21 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

A 1.22 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;
- the potential of alternative technology delivery platforms to support competition.

Other relevant obligations under the Framework and

Authorisation Regulations

Framework Regulations

A 1.23 Regulation 17 of the Framework Regulations governs the management of radio frequencies for electronic communications services. 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 electronic communications services;
- that spectrum allocation used for electronic communications services 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 1.24 Regulation 17(2) provides that, unless otherwise provided in Regulation 17(3), ComReg must ensure that all types of technology used for electronic communications services may be used in the radio frequency bands that are declared available for electronic communications services in the Radio Frequency Plan published under Section 35 of the 2002 Act in accordance with EU law.

A 1.25 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 electronic communications services 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 1.26 Regulation 17(4) requires that, unless otherwise provided in Regulation 17(5), ComReg must ensure that all types of electronic communications services may be provided in the radio frequency bands, declared available for electronic communications services in the Radio Frequency Plan published under Section 35 of the Act of 2002 in accordance with EU law.

A 1.27 Regulation 17(5) provides that, notwithstanding Regulation 17(4), ComReg may provide for proportionate and non-discriminatory restrictions to the types of electronic communications services to be provided, including where necessary, to fulfil a requirement under the International Telecommunication Union Radio Regulations ("ITU-RR").

A 1.28 Regulation 17(6) requires that measures that require an electronic communications service to be provided in a specific band available for electronic communications services 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 1.29 Regulation 17(7) provides that ComReg may only prohibit the provision of any other electronic communications service 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 1.30 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 1.31 Regulation 17(9) provides that Regulations 17(2) to (7) only apply to spectrum allocated to be used for electronic communications services, general authorisations issued and individual rights of use for radio frequencies granted after the 1 July 2011. Spectrum allocations, general authorisations and individual rights of use which already existed on the 1 July 2011 Framework Regulations are subject to Regulation 18.

A 1.32 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 1.33 Regulation 17(11) requires ComReg to, in the fulfilment of its obligations under that Regulation, respect relevant international agreements, including the ITU Radio Regulations and any public policy considerations brought to its attention by the Minister.

Authorisation Regulations

Decision to limit rights of use for radio frequencies

A 1.34 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 1.35 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 1.36 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 1.37 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 1.38 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 1.39 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 1.40 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 1.41 Regulation 10(02) 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 1.42 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 1.43 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 1.44 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 1.45 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 1.46 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.

Amendments of rights and obligations

A 1.47 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).

Other Relevant Provisions

Wireless Telegraphy Act, 1926 (the "1926 Act")

A 1.48 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 1.49 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 1.50 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 1.51 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 1.52 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.

Article 4 of Directive 2002/77/EC (Competition Directive)

A 1.53 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."

EECC and other relevant standards

A 1.54 The project team has taken account, where relevant, of:

- provisions of Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code including, for instance, provisions relating to spectrum rights of use, whilst noting that this Directive has yet to be transposed in this jurisdiction;
- reports by the International Telecommunication Union ("ITU"), including Report ITU-R SM.2351 (Smart grid utility management systems), Working Document towards a preliminary draft revision of Report ITU-R SM.2351-2, 28 June 2018;
- standards of the European Telecommunications Standards Institute ("ETSI"), including ETSI TR 103 528: "SmartM2M; Landscape for open source and standards for cloud native software applicable for a Virtualized IoT service layer" and ETSI TR 103 527: "SmartM2M; Virtualized IoT Architectures with Cloud Back-ends".

Annex: 2 Block Edge Masks

A) Base station transmitter mask for systems operating with a channel bandwidth of 1.4 MHz and greater[195].

Channel width	Delta Fc (MHz) from centre frequency	Out-of-band emissions (transmitter output power)	Measurement bandwidth
1.4 MHz	0.7 to 2.1	-1 dBm -10/1.4 * (Delta F_C – 0.7) dB	100 kHz
	2.1 to 3.5	-11 dBm	100 kHz
	3.5 to 9.95	-16 dBm	100 kHz
3 MHz	1.5 to 4.5	-5 dBm -10/3* (Delta F_C – 1.5) dB	100 kHz
	4.5 to 7.5	-15 dBm	100 kHz
	7.5 to 9.995	-16 dBm	100 kHz
5 MHz	2.5 to 7.5	-7 dBm -7/5* (Delta F_C – 2.5) dB	100 kHz
	7.5 to 9.95	-14 dBm	100 kHz

Note 1: for the maximum mean out-of-block e.i.r.p. the antenna gain and cable losses of the land mobile system have to be considered.

Note 2: additional out-of-band emission reduction may be necessary for the protection of other land mobile systems in the adjacent bands (see ECC Report 283). For the protection of the uplink frequencies of land mobile systems within 410-420 MHz, a maximum mean out-of-block e.i.r.p. of -43 dBm/100 kHz may be needed.

Note 3: additional 40 dB of out-of-block emission reduction may be needed for the protection of radiolocation services).

Table A1. BS frequency range of out-of-block emissions (1.4 MHz, 3 MHz and 5 MHz channel bandwidth)

[195] Although 5 MHz is listed, licensees are reminded that the maximum channel available in this award process is 2 × 4 MHz.

Frequency offset from centre frequency (MHz)	Channel width 1.25 MHz	Measurement bandwidth
±0.885-1.98	-17 dBm	30 kHz
±1.98-4	-22 dBm	30 kHz

Table A2: BS frequency range of out-of-block emissions (1.25 MHz channel width)

B) User Equipment for systems operating with a channel bandwidth of 1.4 MHz and greater.

Parameter	Value
Channel bandwidth	1.25, 1.4, 3 or 5 MHz
Maximum mean in-block power	31 dBm
Note: Licensees should use the minimum power required to deploy their network. If interference should occur then licensees may be required to lower their in-block UE transmitter power as necessary to provide protection of other services, networks and applications.	

Table A3: UE transmitter characteristics

Frequency offset from channel edge (MHz)	Channel width			Measurement bandwidth
	1.4 MHz	3 MHz	5 MHz	
±0-1	-10 dBm	-13 dBm	-15 dBm	30 kHz
±1-2.5	-10 dBm	-10 dBm	-10 dBm	1 MHz
±2.5-2.8	-25 dBm	-10 dBm	-10 dBm	1 MHz
±2.8-5		-10 dBm	-10 dBm	1 MHz
±5-6		-25 dBm	-13 dBm	1 MHz
±6-10			-25 dBm	1 MHz

Table A4: UE maximum unwanted emission levels (1.4 MHz, 3 MHz and 5 MHz channel width)

Frequency offset from channel edge (MHz)	Channel width 1.25 MHz	Measurement bandwidth

±0.885-1.98	-24 dBm	30 kHz
±1.98-4	-44 dBm	30 kHz

Table A5: UE maximum unwanted emission levels (1.25 MHz channel bandwidth)

C) Technical requirements for systems utilising a bandwidth of 6.25 kHz to 200 kHz.

The technical requirements for channel bandwidths of between 6.25 kHz and 200 kHz are as follows:

a. Wanted channel effective radiated power: 31 dBm for user equipment and 50 W for Base Station equipment.

b. Adjacent and alternate adjacent channel power: Power in upper and lower channels, as well as in the lower and upper alternate adjacent channels, shall not exceed a value of 60 dBc below the transmitter power level without the need to be below the -36 dBm e.r.p.

Unwanted emissions in the spurious domain: During operation shall not exceed -36 dBm. During standby shall not exceed -57 dBm.

Annex: 3 450 – 470 MHz band overview

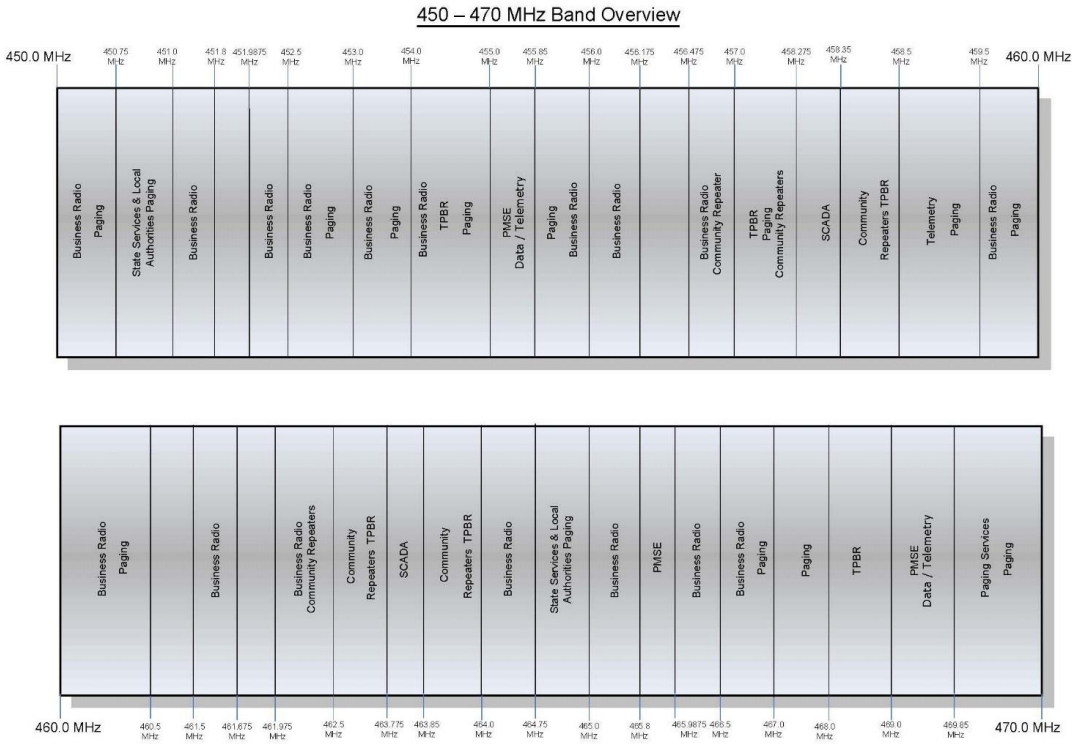

Figure 1. 450 – 470 MHz band overview