



Commission for
Communications Regulation

RADIO SPECTRUM MANAGEMENT STRATEGY STATEMENT 2016-2018

COMREG DOCUMENT NUMBER: 16/50

DATE: 21 JUNE 2016



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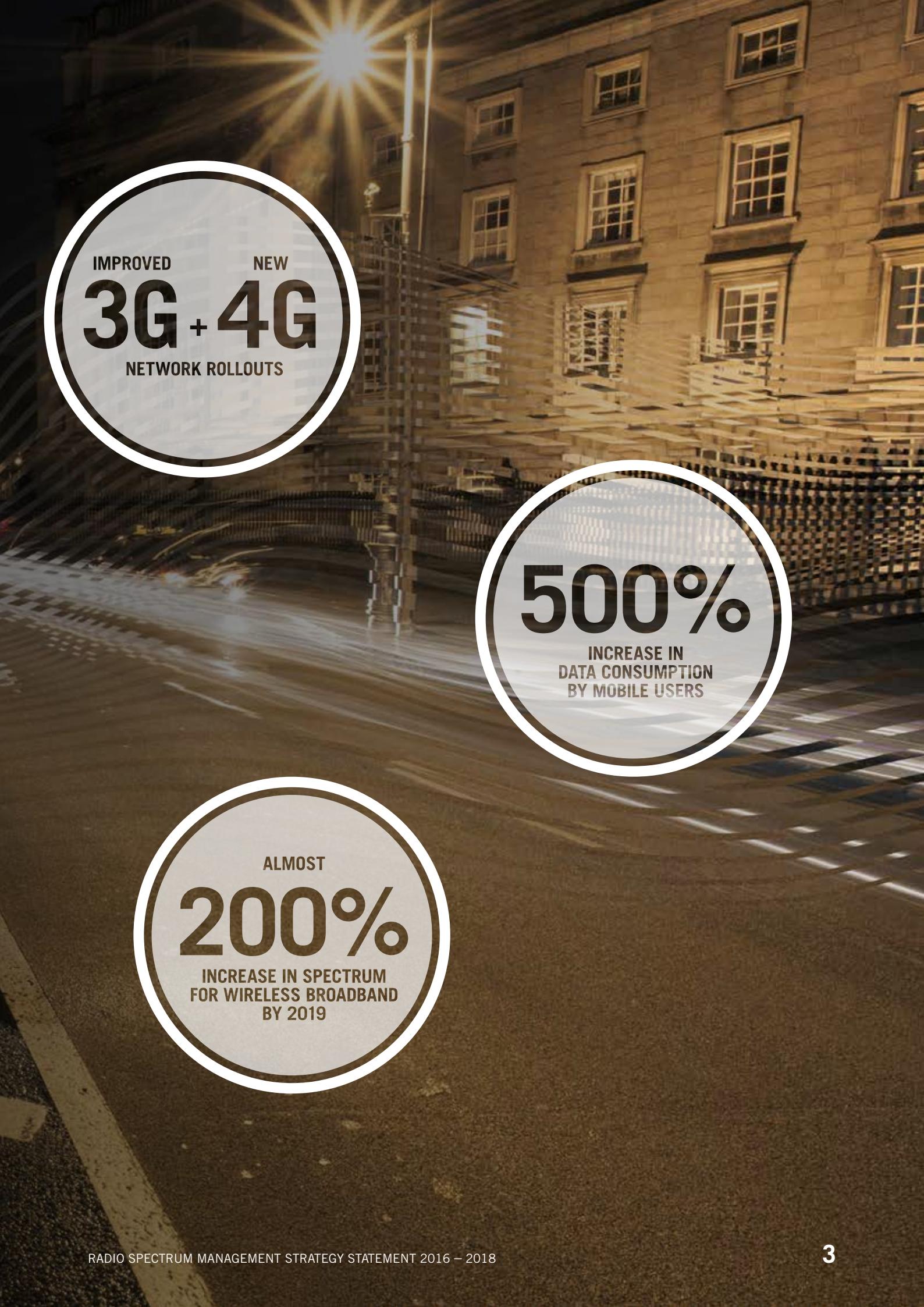
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1. FOREWORD

The radio spectrum is an increasingly valuable and useful resource for the nation, contributing to the improvement of overall welfare of many sectors of society by supporting an extensive range of desirable, useful and essential services. It also helps deliver economic growth and supports numerous jobs in the modern economy. ComReg's Radio Spectrum Management Strategy statement sets out how we plan to ensure the effective and efficient management of this important resource in the period ahead.

In the recent past we have experienced a significant inflection point in relation to the impact that the use of the radio spectrum resource can have on our daily lives and business activities – in particular with the rapid, unheralded ascent of the smartphone to a role of a lifestyle- and productivity-enhancing device in the space of a few short years. Associated with this development has been the very rapid increase in the amount of data users are consuming, an increase exceeding 500% since 2012, facilitated in particular by improved 3G and new 4G network rollouts. The use of wireless devices, such as smartphones, tablets and dongles, in providing wireless broadband access to the internet is now an important dimension of meeting the demand for broadband services for many users.

While ComReg's previous Radio Spectrum Management Strategy Statement 2011 – 2013 appreciated the potential impact of smart mobile devices, the true impact of the smartphone could not have been fully foreseen. Notwithstanding, the 2011 Strategy clearly highlighted the importance of the rollout of the 4G networks through the release of unused spectrum, the liberalisation of several mobile spectrum bands and the re-farming of the 800 MHz band from broadcasting to mobile broadband use. Thus the priorities we determine in our spectrum management strategy can have far reaching implications. That is why we set out our preliminary thinking on activities and priorities for managing the scarce radio spectrum resource for public comment. We have now carefully considered that input, and where appropriate, we have adjusted and modified our proposed activities accordingly.



IMPROVED
3G + 4G
NEW
NETWORK ROLLOUTS

500%
INCREASE IN
DATA CONSUMPTION
BY MOBILE USERS

ALMOST
200%
INCREASE IN SPECTRUM
FOR WIRELESS BROADBAND
BY 2019

1. FOREWORD

CONT.

The massive increase in mobile data usage in recent years sees no sign of abating and a significant element of ComReg's strategy, as supported by stakeholders, is to prioritise the release of spectrum capable of supporting wireless broadband use both in a fixed and mobile context. ComReg has set out a strategy which could see spectrum being made available for wireless broadband delivery increasing by almost 200% by 2019. For example, the upcoming release of the 3.6 GHz band, the future release of the 700 MHz band with its favourable characteristics for the provision of both wide area and indoor coverage, and the further anticipated release of other spectrum bands including the 1.4 GHz, 2.3 GHz and 2.6 GHz bands, could go a significant way to meeting increasing demands for mobile data, including supporting broadband availability for all users and in as many locations as possible.

While usage and devices have changed rapidly in the past few years so also have consumer expectations evolved significantly. Absent the smartphone revolution, prior generations of mobile network licences, including the most recent multi-band liberalised licences, had associated coverage obligations reflective of traditional mobile phone voice-usage. However, those trusty voice-centric devices have now almost completely disappeared. The modern generation of multi-functional, multi-band smartphone devices have typically less sensitive receivers and the consumer experience of mobile coverage may not be as good as with the older voice-centric devices. In addition there is an evident trend towards relying on mobile devices when indoors, while otherwise sensible modern building conventions focused on enhancing thermal efficiency serve to impact negatively on indoor signal delivery. These trends along with the increased lifestyle dependence on the smartphone appears to have led to a broadly based public view of reducing mobile voice coverage and growing societal frustration with the experience of services delivered by wireless means.

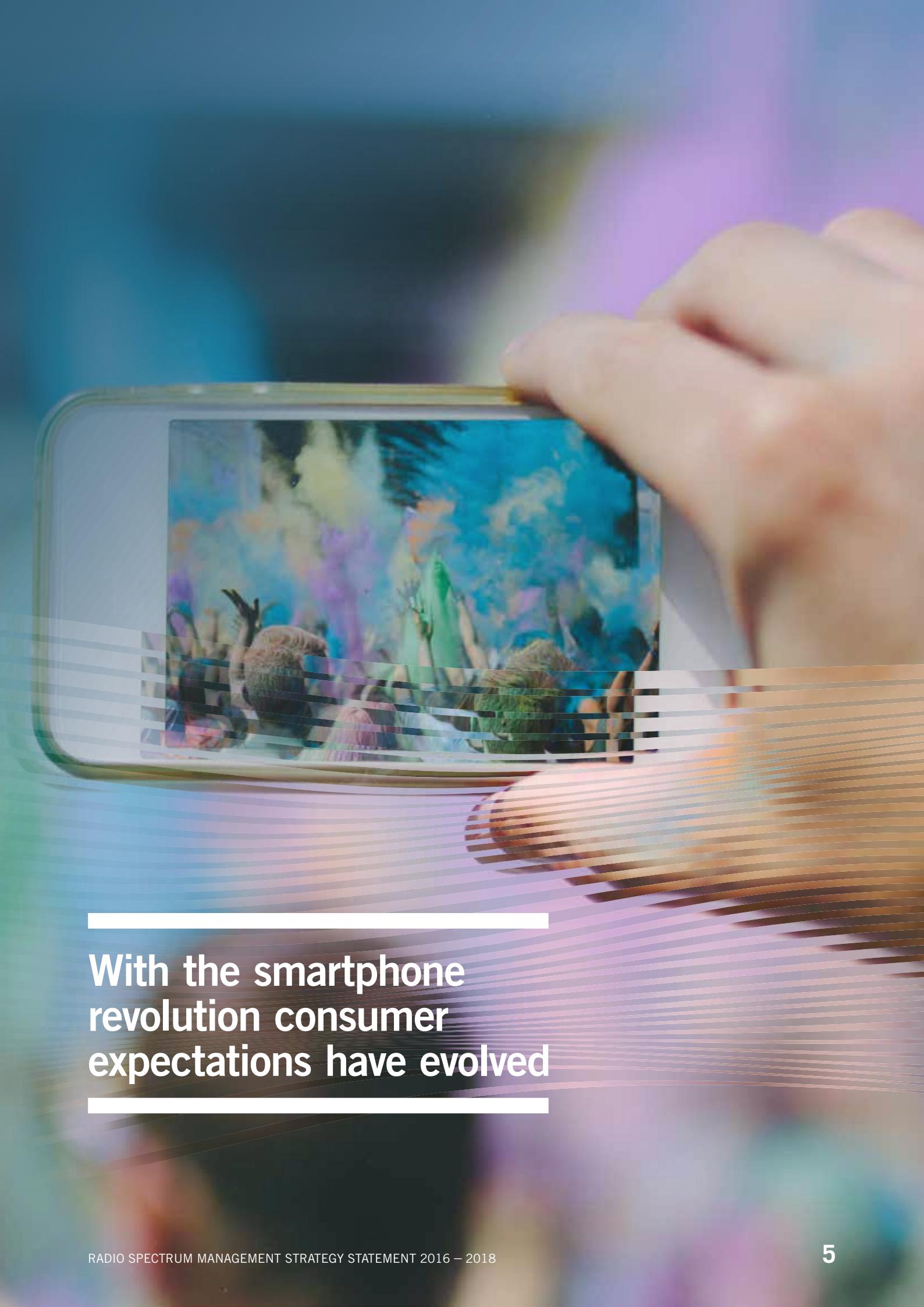
It behoves us therefore to treat seriously this view and to gain a detailed understanding of the drivers of this issue and identify potential solutions, some of which ComReg may be in a position to promote or facilitate. Other solutions, such as may exist in alterations to the planning processes, may require other measures outside the scope of ComReg's remit. It will be possible to take into account the changing nature of consumer expectations when designing future spectrum releases.

However, it should always be borne in mind that mobile coverage in Ireland, which has exceeded well over 90% of the population (as distinct from geography) for 2G and 3G for many years and the continued roll out of 4G networks, is essentially a product of competitive forces which have promoted service deployment via innovation and investment. ComReg recognises that competitive forces, left to their own devices, may not deliver ubiquitous coverage due to the uncommercial nature of network roll out in some geographic areas. If society is demanding a more extensive coverage of services than can realistically be provided through commercial means, then as with the National Broadband Plan and as can be seen in other European markets, a policy initiative may be appropriate to fill any gap between societal demands and commercial viability in respect of wireless coverage. In any event, through its spectrum-related activities ComReg will endeavour to get a greater understanding of the issues and to seek solutions which can deliver improved outcomes and to support the proposed Government's Task Force on both rural mobile coverage and broadband.

Other specific action items, such as in the area of spectrum that could be used for smart meters, ground station facilities for mobile satellite communications, are also foreseen in the spectrum strategy and these in turn have the potential to support valuable services in each particular sector. In addition general business and industrial use of spectrum for backbone delivery of communications, broadcasting and in support of business radio is also anticipated. Measures to support preparation for 5G through Test and Trial Ireland are also planned. Equally scientific users, trialists and hobbyists are supported through the delivery of this Radio Spectrum Management Strategy.

In preparing this Strategy Statement ComReg has taken into account its role, statutory objectives, all relevant obligations as well as material submitted in response to the public consultation. ComReg is also conscious of the potential developments at the EU level in respect of spectrum management which may impact on national spectrum strategies and policies in due course.

Commissioner Gerry Fahy



With the smartphone revolution consumer expectations have evolved

2. EXECUTIVE SUMMARY

Radio spectrum is the medium over which all wireless communications (such as mobile phones, radars, radios, televisions, connected devices etc.) take place and is a valuable national resource underpinning important economic, social and communications activities.

In Ireland, the Commission for Communications Regulation (ComReg) is the statutory body responsible for the management of radio spectrum. Following public consultation on its draft radio spectrum management strategy¹, this document sets out ComReg's final strategy for the period 2016 to 2018.

In setting out its strategy, ComReg has considered the economic contribution of radio spectrum to Irish gross domestic product (GDP). This continues to increase. Based on the most recent data available (2014), ComReg's analysis conservatively estimates that this contribution was over €4.7 billion, or approximately 2.5% of GDP, with almost 29,000 people employed through the use of radio spectrum.

In order to inform this strategy, ComReg has reflected on a number of significant developments that have occurred in recent times, including the:

- successful assignment of an additional 150 MHz of spectrum rights of use for mobile wireless broadband services in the 2012 Multi-Band Spectrum Award (MBSA) process;
- subsequent rollout of improved 3G and new 4G services, and the increased user demand for mobile data services driven by the near ubiquitous availability of smartphones. Between Q1 2012 and Q1 2016, data usage on Irish mobile networks increased by over 500% and forecasts indicate significant increases continuing for many years to come²;

¹ Consultation 15/131 sets out ComReg's draft radio spectrum management statement for the period 2016 to 2018. Document 16/49 sets out ComReg's response to consultation on this consultation.

² Frontier Economics Ltd conservatively estimate that between 2015 and 2035 mobile data usage demand in Ireland could increase 33 times (see ComReg Document 15/62, 15/62a and 15/62b).

A valuable natural resource underpinning important economic, social and communications activities



2. EXECUTIVE SUMMARY

CONT.

- › acquisition of Telefónica Ireland Limited (Telefonica) by Hutchison 3G UK Holdings Limited (Hutchison) which was conditionally approved by the European Commission (EC) in 2014. This reduced the number of mobile networks operators (MNOs) in Ireland from four to three. In keeping with its statutory powers, ComReg will continue to monitor the competitive dynamic of the mobile markets affected but observes that it remains too early to draw any conclusions on the effect of this acquisition on competition in the relevant mobile markets;
- › public perception that the mobile retail consumer experience has deteriorated and the importance of addressing this issue as recently highlighted by the priorities set out in the programme for Government;
- › considerable work by Ireland to prepare for the migration of the Digital Terrestrial Television (DTT) service to below the 700 MHz band. ComReg's understanding is that Ireland's 700 MHz migration activities are indicatively planned for the time period 2019/2020 (i.e. a period of 3-4 years from now); and
- › proposals by ComReg to release as much as a further 740 MHz of spectrum rights in a number of harmonised radio spectrum bands (e.g. 700 MHz, 1.4 GHz, 2.3 GHz, 2.6 GHz and/or 3.6 GHz) suitable for mobile, nomadic and fixed wireless broadband.

The strategy also considers potential radio spectrum demand of specific radiocommunication service categories³, noting that this demand is influenced by a broad range of factors including end-user demand, technology changes and advancements, the international harmonisation of radio spectrum, and relevant national and international policies and directives.

THE SPECTRUM MANAGEMENT WORK PLAN FOR 2016 TO 2018

ComReg aims to manage its workload in a manner that attempts to appropriately and pragmatically address the needs of a diverse range of actual and potential spectrum users. Relevant considerations in this regard include: the capacity within the existing radio spectrum bands to meet spectrum demands; the international harmonisation status of various radio spectrum bands; the potential for including multiple spectrum bands in a single award process; the adoption of legislation (both national and European) which requires ComReg to take certain actions within certain timeframes; and the adoption of national priorities supported by legislation or similar instruments.⁴ ComReg balances these considerations so as to establish a prioritised work plan commensurate with its resources.

The spectrum work plan for 2016 to 2018 outlines the spectrum activities that ComReg intends to carry out within this timeframe. These include:

- › completing the assignment process for the 3.6 GHz band significantly in advance of the expiry of existing FWALA licences on 31 July 2017;
- › actively engaging with relevant stakeholders to progress the repurposing of the 700 MHz band so as to obtain clarity on its timing availability;
- › further developing ComReg's award proposals in relation to the 700 MHz, 1.4 GHz, 2.3 GHz, and 2.6 GHz bands;
- › collaborating with the Broadcasting Authority of Ireland (BAI) and 2rn to finalise an internationally-coordinated spectrum and transition plans for DTT services in the UHF band below the 700 MHz band; and
- › promoting Test and Trial Ireland and the benefits of using Ireland as a location to test or trial wireless products and services in a real world environment.

³ Radiocommunication service is a specific term related to frequency management within the International Telecommunications Union (ITU) and defined as "A service involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes".

In this strategy document, unless otherwise stated, radiocommunication relates to the following service categories: mobile, nomadic and fixed wireless broadband; broadcasting; radio links; business radio (including PPDR and PMSE); short range devices (including "internet of things"); satellite; radio amateur; aeronautical, defence maritime and scientific services.

⁴ The extent to which any of these considerations may affect ComReg's prioritisation is considered on a case by case basis.

ComReg's spectrum work plan also reflects its statutory functions, objectives and duties, including to promote competition, to contribute to the development of the internal market, to promote the interests of users and to ensure the efficient management and use of the radio frequency spectrum in Ireland.

This strategy also sets out ComReg's current thinking on a number of prevailing spectrum management issues including: the use of auctions, radio spectrum competition caps, spectrum trading (transfers and leases), licence duration, fees for spectrum rights, sharing and collaborative arrangements, the mobile retail consumer experience, technology and service neutrality and transparency of information.

STRUCTURE OF THE DOCUMENT

This document is structured as follows:

Chapter 3

provides an introduction to spectrum management in Ireland outlining the importance of radio spectrum and ComReg's spectrum management activities;

Chapter 4

outlines a number of the significant developments in radio spectrum use that have occurred in the Irish market since 2011;

Chapter 5

discusses the potential radio spectrum demand of specific radiocommunication service categories;

Chapter 6

sets out ComReg's radio spectrum work plan for the period 2016 to 2018; and

Chapter 7

sets out ComReg's current thinking on several topical spectrum management issues.

ANNEXES SUPPORTING THIS DOCUMENT:

Annex 1

Summary of ComReg's statutory framework relevant to the management of the radio frequency spectrum in Ireland; and

Annex 2

Methodology used in calculating the economic contribution of radio spectrum to Ireland.

3. INTRODUCTION TO SPECTRUM MANAGEMENT IN IRELAND

The Commission for Communications Regulation (ComReg) is the statutory body responsible for the regulation of the electronic communications (telecommunications, radiocommunication and broadcasting networks), postal and premium rate sectors in Ireland in accordance with European Union (EU) and Irish law. ComReg also manages the radio frequency spectrum (“radio spectrum” or “spectrum”) and the national numbering resource, among other responsibilities.

3.1 INTRODUCTION

Radio spectrum is a medium by which information may be transmitted wirelessly over distances ranging from a few metres to thousands of kilometres. Its usage as a means of transferring information continues to increase and for many services radio spectrum is an essential input. These include widely used services, such as mobile and fixed wireless communications, radio and TV broadcasting, and the safe operation of air and maritime transport. In addition, radio spectrum is fundamental in the day-to-day operation of the emergency services and defence forces and is a vital input to many other services including important scientific applications, such as weather forecasting and monitoring the Earth's environment.

To assist ComReg's management of the radio spectrum, ComReg regularly sets out and updates its spectrum management strategy. ComReg's draft radio spectrum management plan for 2016 to 2018 is set out in ComReg Document 15/131⁵ (“Consultation 15/131”) and ComReg's consideration of the responses received from interested parties to this consultation is set out in ComReg Document 16/49⁶.

This document sets out ComReg's final radio spectrum management strategy and spectrum work plan for the period 2016 to 2018.

3.2 THE IMPORTANCE OF RADIO SPECTRUM

Analysis carried out by ComReg⁷, based on company financial records and data from the national accounts, conservatively suggests that the economic contribution to Irish Gross Domestic Product (GDP) arising from the use of radio spectrum in 2014 was over €4.7 billion, or approximately 2.5% of GDP⁸.

Figure 1 illustrates the relationship between Ireland's GDP in years 2010 to 2014 with the aggregate estimated economic contribution from the use of radio spectrum over the same period. This graph highlights that the direct contribution of radio spectrum increased from €4bn in 2010 to €4.7bn in 2014, when modest multiplier effects are taken into account.

Radio spectrum is also an important contributor to employment. A conservative estimate of the number of employees in Ireland whose jobs are dependent on the use of radio spectrum was nearly 29,000 for 2014⁹.

⁵ http://www.comreg.ie/_fileupload/publications/ComReg15131.pdf

⁶ http://www.comreg.ie/_fileupload/publications/ComReg16/49.pdf

⁷ The methodology used in this analysis is set out in Annex 2 of this document.

⁸ This is a conservative estimate of the performance of the sector. For example, it does not include satellite operations due to the unavailability of financial information relating to the Irish economy from these firms.

⁹ These conservative estimates understate the total contribution of spectrum as it was not possible to value all services because of lack of data.

SOCIAL AND CULTURAL BENEFITS OF SPECTRUM USAGE

There are also considerable social benefits¹⁰ arising from the use of radio spectrum. For example, the efficient functioning of the Gardaí, fire and ambulance services depends on reliable mobile communications, while radio speaks a major role in enabling the Defence Forces to carry out their duties both at home and overseas. Radio spectrum is also fundamental to the safe operation of air, sea and land transport and Ireland plays a particularly important role in managing international radio traffic in the aeronautical sector, dealing with all civilian flights between Europe and North America. Access to sufficient spectrum is necessary in facilitating free-to-air television and radio broadcasting by the public service and independent broadcasters. Effective free-to-air delivery of national and regional broadcast schedules helps ensure media plurality, a greater expression of national and community cultural identity and the development of home-grown audio-visual content, including drama and documentary.

The use of radio spectrum, through its ability to facilitate the encouragement of new technologies and innovation, also positively contributes to improvements in productivity. While this is not measured directly, many commentators acknowledge the link between increased use of Information & Communications Technology (ICT) and greater productivity.¹¹

3.3 SPECTRUM POLICY IN IRELAND

A key role of the Department of Communications, Energy and National Resources (DCENR) is the development of policies for the regulation and optimal use of Ireland's national radio frequency spectrum, underpinned by an appropriate legislative framework. Spectrum policy is part of the national policy governing the telecommunications sector in Ireland, which also covers next generation broadband, electronic communications services and international connectivity.

The DCENR also has the responsibility of developing national broadcasting policy and associated spectrum use.

The DCENR is in the process of updating¹² its spectrum policy statement¹³.

3.4 SPECTRUM MANAGEMENT IN IRELAND: COMREG'S MANDATE AND ROLE

The Communications Regulation Acts 2002 (as amended) (the "2002 Act"), the European Common Regulatory Framework for electronic communications networks (ECN) and services (ECS) (including the Framework and Authorisation Directives¹⁴ as transposed into Irish law by the corresponding Framework and Authorisation Regulations¹⁵), and the Wireless Telegraphy Acts 1926 to 2009 (as amended)¹⁶ (the "1926 Act") set out, among other things, functions, objectives, powers and duties that are relevant to ComReg's management of the radio spectrum.

In exercising its function of the management of Ireland's radio frequency spectrum (and in accordance with relevant ministerial Policy Directions given under section 13 of the 2002 Act), ComReg's primary objective is to ensure the efficient management and use of the radio spectrum. ComReg is obliged to effectively carry out this function, including having regard to relevant government policy statements and international developments.

Readers are referred to Annex 1 for a summary of the legal framework and statutory objectives relevant to management of radio spectrum.

As radio spectrum is a finite resource with many different services and users, radio spectrum management involves the careful consideration of a broad range of factors (e.g. administrative, regulatory, social, economic and technical) with a view to ensuring that radio spectrum is optimally and efficiently used. This may also involve balancing a range of competing factors, including:

¹⁰ These social benefits are not included in the calculation of the contribution of radio spectrum to GDP.

¹¹ A large body of evidence suggests that affordable and effective broadband connectivity is an enabler of economic growth such as various publications by the Broadband Commission including:

- The Impact of broadband on the economy, 2011 (broadbandcommission.org/reports);
- The State of Broadband 2015, Universalising Broadband and ITU, Technology Broadband and Education: Advancing Education for all Agenda 2013, and
- Lars-Hendrik Röller, Leonard Waverman, "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach," American Economic Review, Vol. 91, No. 4 (2001), pp. 909-923.

¹² DCENR, Consultation on spectrum policy priorities. 7 July 2014.

¹³ DCENR Spectrum Policy Statement, 2010

¹⁴ Directive No. 2002/21/EC (as amended by Regulation (EC) No. 717/2007, Regulation (EC) No. 544/2009 and Directive 2009/140/EC) (the "Framework Directive") and Directive No. 2002/20/EC (as amended by Directive 2009/140/EC) (the "Authorisation Directive")

¹⁵ European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. No. 333 of 2011) ("Framework Regulations") and the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011 (S.I. No. 335 of 2011) ("Authorisation Regulations").

¹⁶ The Wireless Telegraphy Acts, 1926 and 1956, the Broadcasting Authority Acts, 1960 to 1971, in so far as they amend those Acts, the Wireless Telegraphy Act 1972, Sections 2, 9, 10, 11, 12, 14, 15, 16, 17 and 19 of the Broadcasting and Wireless Telegraphy Act 1988 and Sections 181 (1) to (7) and (9) and Section 182 of the Broadcasting Act 2009.

FIGURE 1: CONTRIBUTION OF RADIO SPECTRUM TO GDP: 2010 – 2014





**Economic contribution
to Irish Gross Domestic
Product (GDP) arising
from the use of radio
spectrum in 2014
was over €4.7 billion,
or approximately
2.5% of GDP**

3. INTRODUCTION TO SPECTRUM

MANAGEMENT IN IRELAND

CONT.

- appropriately meeting the requirements of all radio services, including commercial and public uses, such as public safety, national security and health care; and
- for spectrum used for ECS and ECN, promoting competition including ensuring that users derive maximum benefit in terms of price, choice and quality, contributing to the development of the internal market, and promoting the interests of users within the Community.

Effective spectrum management also requires flexibility and responsiveness so as to adapt to changes in, among other things, technologies, demand from spectrum users and end-users, market developments and relevant public policy.

3.5 OVERVIEW OF COMREG'S SPECTRUM MANAGEMENT ACTIVITIES

In fulfilling its spectrum management function, ComReg carries out a range of activities including the:

- promotion of Ireland's interests in international fora;
- allocation and assignment of radio spectrum in Ireland;
- licensing of radio spectrum for a wide variety of uses;
- monitoring of radio spectrum usage in Ireland, including the enforcement of licence conditions and equipment standards; and
- promotion of Ireland as an ideal location for spectrum development using Test and Trial Ireland.

3.5.1 INTERNATIONAL ASPECTS TO SPECTRUM MANAGEMENT

As radio frequencies naturally extend beyond national borders, spectrum management requires knowledge of, and involvement in, European and global spectrum management developments. Much of the radio spectrum requires international planning and in some cases this may constrain how specific frequencies or frequency bands may be used.

This is particularly so in the aeronautical and maritime sectors where, because of the global nature of these services, ships and aircraft must use specific frequencies for navigation and communication purposes. The TV and radio broadcasting bands have also been harmonised for many decades to facilitate coordination between neighbouring countries and to assist the development of consumer markets. More recently, an increasing number of radio frequency bands have been internationally harmonised for commercial radio systems, such as wireless mobile communications.

While the 'allocation' and/or 'assignment' of spectrum is a national function, the global regulation of spectrum is primarily within the remit of the International Telecommunication Union (ITU), and European regulatory functions lie with the European Union (EU) and the European Conference of Postal and Telecommunications Administrations (CEPT). These bodies define the broad framework within which all spectrum users must operate and, in some cases, these bodies develop harmonised decisions, recommendations, and approaches to the use of spectrum. Harmonised radio frequency bands provide considerable benefits in facilitating the development of international services, promoting economies of scale with respect to the manufacture of radio equipment (thereby lowering both the cost of deploying wireless networks and the cost of wireless devices for consumers), and minimising the risk of interference between users.

As the radio spectrum manager, ComReg is charged with the implementation of international treaties and obligations¹⁷ relating to the use of radio spectrum in the State. The implementation of these measures often requires actions in relation to the allocation and/or assignment of radio spectrum as discussed below.

Along with the DCENR, ComReg plays an active role in international fora to ensure that, as far as possible, decisions relating to the international radio spectrum regulatory framework accommodate Ireland's specific requirements. ComReg additionally participates in technical compatibility studies and in the development of technical standards to support more efficient and flexible use of radio spectrum (usually in working groups of the CEPT).

¹⁷ The interference-free operation of radiocommunication systems across international borders is achieved through the implementation of the Radio Regulations and Regional Agreements, and the efficient and timely update of these instruments through the processes of the World and Regional Radiocommunication Conferences. The Radio Regulations, which have the status of an international intergovernmental treaty, provide a framework for the use of the radio frequency spectrum and satellite orbits. To keep pace with the fast development of technologies and the consequent convergence of services and technologies, the Radio Regulations are revised every three to four years at a World Radiocommunication Conference (WRC). The last WRC was held in November 2015 in Geneva.

The radio spectrum decisions and recommendations of the CEPT (ECC Decisions and ECC Recommendations) are non-binding on national administrations. The list of ECC Decisions/Recommendations and their implementation status for all CEPT countries, including Ireland, is maintained at <http://www.erodochdb.dk>.

The radio spectrum decisions of the EU (the EU/EC Decisions) are binding decisions on EU Member States. These decisions are normally based on the relevant technical harmonisation measures as outlined in the CEPT reports to the EC and are generally adopted subsequent to the prior adoption of a CEPT ECC Decision. A list of EU Decisions/Recommendations is maintained at <https://ec.europa.eu/digital-agenda/en/radio-spectrum-policy-document-archive>

3.5.2 THE ALLOCATION AND ASSIGNMENT OF RADIO SPECTRUM IN IRELAND

THE ALLOCATION OF RADIO SPECTRUM IN IRELAND

The **allocation** of radio spectrum means “*the designation of a given frequency band for use by one or more types of radiocommunications services, where appropriate, under specified conditions*”.¹⁸ An allocation identifies the services that could potentially use a radio frequency band and is an important activity in facilitating the international coordination of radio spectrum between regional areas and neighbouring countries, thereby reducing the potential for interference and enabling economies of scale.

ComReg’s radio frequency plan for Ireland¹⁹ (the “RF Plan”) sets out Ireland’s radio spectrum allocations for 9 kilohertz to 3000 gigahertz. The RF Plan is updated regularly in line with the outcomes of the International Telecommunication Union (ITU) World Radiocommunication Conferences (WRCs) and other relevant developments, such as the adoption of European harmonisation decisions and recommendations for a particular radio frequency band or service.

THE ASSIGNMENT OF RADIO SPECTRUM IN IRELAND

The **assignment** of radio spectrum refers to the spectrum management activities that issues, and authorises the use of, rights of use of radio frequencies²⁰. In Ireland, the possession and/or use of radio equipment requires authorisation from ComReg and this authorisation may take the form of either a licence or a licence exemption under the Wireless Telegraph Acts.

Licence exemptions refer to radio equipment that operates on a non-interference, non-protected basis and in radio spectrum that is shared with other radio devices. To exempt the possession of such radio equipment from requiring a licence under the Wireless Telegraph Acts, exemption orders are made by ComReg under the same act. A wide range of devices have been made licence-exempt including, for example, short ranges devices²¹ (e.g. Wi-Fi, bluetooth, medical devices, radio frequency identification applications (RFIDs)), mobile and cordless phones, etc. In the context of ECN/ECS, ComReg observes that rights of use for radio

frequencies are required to be facilitated under a general authorisation except where ComReg considers that individual rights of use are specifically required to be granted²².

The licensing of radio spectrum refers to the provision of an authorisation or an individual rights of use to a specified party (the licensee) under specified conditions. This authorisation facilitates the possession and/or use of radio equipment for specific radio frequencies within a spectrum band and may contain licence conditions in relation to its use. The majority of ComReg’s radio spectrum work relates to the licensing of spectrum and its conditions of use.

For example, (a) determining the precise nature of spectrum rights (e.g technical conditions, geographic dimension, licence duration, licence conditions etc.), (b) designing and implementing awards of spectrum rights, and (c) granting rights of use/licences on foot of same.

In the context of spectrum rights used for the provision of ECN/ECS, ComReg may grant individual rights of use under defined circumstances. In addition, ComReg may limit the number of rights of use to be granted where this is necessary to ensure the efficient use of spectrum.²³ Further, ComReg is obliged to ensure that the issue of individual rights of radio frequencies is:

- based on objective, transparent, non-discriminatory and proportionate criteria²⁴; and
- on foot of open, objective, transparent, non-discriminatory and proportionate procedures, which are required to be made publicly available²⁵.

¹⁸ Framework Regulations.

¹⁹ ComReg Radio Frequency Plan for Ireland: ComReg Document 13/118R, last updated October 2015

²⁰ A spectrum assignment refers to the rights of use for specific radio frequencies within a frequency band issued to an individual or for a station and usually under specified conditions (e.g. in the context of radio frequencies for ECS, one or more of the conditions identified in Part B of the Schedule to the Authorisation Regulations).

²¹ See ComReg Document 02/71 as revised. This document is updated on a regular basis in line with relevant harmonisation, with the last update being in May 2016.

²² Regulation 9 (2) of the Authorisation Regulations.

²³ See regulations 9 and 11 of the Authorisation Regulations.

²⁴ Regulation 17 of the Framework Regulations.

²⁵ Regulation 9 of the Authorisation Regulations.



**As of 7 June 2016,
the number of radio
spectrum licences totalled
17,430, which represents
a circa 7% increase over
the 5 year period from
30 June 2011**

FIGURE 2: NUMBER OF LIVE LICENCES FOR THE PERIOD 2011 TO 2016 (30TH JUNE 2011-2016 AND 7TH JUNE 2016)



3. INTRODUCTION TO SPECTRUM

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CONT.

3.5.3 RADIO SPECTRUM LICENCES IN IRELAND

Figure 2 on the previous page presents the total number of radio spectrum licences in force (i.e. 'live' licences) in Ireland over the past 5 years, and highlights that the demand for licences continues to increase. As of 7 June 2016, the number of licences totalled 17,430, which represents a circa 7% increase over the 5 year period from 30 June 2011.

While licences are issued for a wide variety of purposes some radio spectrum licences are more in demand than others. As highlighted in Figure 2 above, the number of radio link licences in Ireland has continued to increase and, as of 7 June 2016, there were 12,195 radio link point-to-point licences, representing circa 70% of all live licences. Point-to-point radio links are used mainly by fixed and mobile operators, broadcasters, utilities and emergency services to provide transmission capacity and networks²⁶, and to provide redundancy and back-up for other networks.

Licences for business radio, aircraft radio and radio amateurs are the next most voluminous licence type. As of 7 June 2016, there were 4,281 live licences for these services, representing circa 25% of all live licences. While the number of radio amateur and aircraft radio licences has grown somewhat over the five years, the number of business radio licences has declined significantly from 1,826 licences in 2011 to 1,011 licences in 2016 (a 45% decrease over this 5 year period).²⁷

The remaining 5% of radio licences cover a variety of licence types including the Fixed Wireless Access Local Area (FWALA) licences (for fixed and nomadic broadband services), the 3G and Liberalised Use licences (which facilitate the provision of mobile services) and air traffic services and land-based maritime services licences (which facilitate the safe operation of air and sea transport).

While licences for mobile wireless broadband represent a small proportion of the total licences issued by ComReg, these licence types comprise a considerable proportion of ComReg's radio spectrum management workload.

3.5.4 MONITORING, COMPLIANCE AND ENFORCEMENT

An important part of ComReg's spectrum management role is maintaining the integrity of the radio spectrum. This includes:

- monitoring and supervising compliance with conditions attached to rights of use (e.g. licence conditions); and
- monitoring the radio spectrum to prevent unauthorised use, including investigating instances of interference reported by licensees and the general public, and taking appropriate enforcement action.

3.5.4.1 INTERFERENCE INVESTIGATION

Investigation cases are prioritised by ComReg in terms of the impact and severity of the unauthorised use.

In this regard, particular attention is given to Air Traffic Control and emergency services given the clear safety-of-life implications. On average, there are 6 serious cases of interference impacting Air Traffic Control and emergency services per annum. Other notable areas in which interference can prove prevalent includes mobile phone networks²⁸ and disruption to fixed line DSL from non-compliant products²⁹.

The number of interference cases continues to grow - rising from 99 cases in 2010 to a projected figure of 140 cases in 2016 (a 46% increase)³⁰.

This upward trend seems likely to continue and is consistent with spectrum usage in the State. For instance, the release of new spectrum bands has precipitated a significant increase in the amount of equipment and consumers utilising the radio spectrum. That is, the more the radio spectrum is utilised the greater the potential for interference to occur. A secondary consideration in this regard is the demand for data. Previous generations of communications standards were quite tolerant to interference meaning that, in practice, many 'interferers' went unnoticed as there was no real discernible drop in service quality. Services such as Global System for Mobile Communications (GSM) for example, were not provisioned for high speed data. Later generations of communications standards, such as High Speed Downlink Packet Access

²⁶ In providing transmission capacity, radio rather than cable is often the preferred solution where constraints such as cost, local topography and the need for access to remote rural locations are important considerations. In such scenarios radio links provide operators with the ability to roll-out rapidly and the capability to install transmission paths as and when required.

²⁷ This decline is likely to be attributed to a number of external factors such as the downturn in the construction industry around 2010 (thereby leading to a reduction in demand for business radio at construction sites), and the increasing trend in substitution services from over the top applications (for example, smart 'apps' which have enabled small and medium enterprises to provide services using mobile communications which they otherwise would have used a business radio licence previously).

²⁸ Interference to mobile phone base stations is common and can cause significant disruption to customers. The most common sources of interference are devices that are not intended for use in Europe which operate in the spectrum rights of use assigned to MNOs in Ireland.

²⁹ Disruption to DSL services is also quite common, the most common source of disruption is electromagnetic energy (often referred to as electrical noise) emitted by electrical machines and other electrical and electronic devices; the majority of these cases are assessed in line with ComReg's activities under the EMC Directive.

³⁰ The lull in complaints from 2013 into 2014 is likely attributable to the changes to the mobile network operators spectrum following the multi-band spectrum award (MBSA) and the acquisition of Telefonica by Hutchison.

(HSDPA) and Long Term Evolution (LTE), are generally not as robust in terms of the impact of interference and this is now having a more discernible impact on service quality.

3.5.4.2 R&TTE AND EMC DIRECTIVES

Following the adoption of EU Decision 786/2008³¹ and EU Regulation 765/2008³², market surveillance of products is mandatory for all market surveillance authorities in Europe. ComReg is the responsible authority for the Electromagnetic Compatibility (EMC) and Radio equipment and Telecommunications Terminal Equipment (R&TTE) Directives in Ireland and it cooperates and coordinates its activities with industry, other national market surveillance authorities, and other EU Member States.

Regulation 765/2008 came into effect in 2010 and since then there has been a steady increase in the number of products that have been inspected as part of ComReg's ongoing market surveillance. This peaked in the 2014-15 period with over 200 products being assessed for compliance. It is envisaged that, subject to resources, the number of tests will increase in the coming years, reflecting the ever increasing number of radio related devices entering the marketplace.

It is important to note that the Radio Equipment Directive (Directive 2014/53/EU), which repeals the R&TTE Directive that is currently in force, will be transposed into Irish law during the lifetime of this strategy. No impact on ComReg's operational productivity is anticipated as a result.

3.5.4.3 REMOTE MONITORING

Since 2012, ComReg has been deploying its remote spectrum monitoring system throughout the country. This system gathers and stores data on spectrum usage which informs ComReg's spectrum management activities, including the assessment of the occupancy of bands currently earmarked for release or repurposing, and the monitoring for any unauthorised use. This system can also assist in the investigation of interference matters resulting in more efficient use of resources and quicker resolution times.

Currently, most of the main population centres in the country are covered (Dublin, Cork, Limerick, Galway, Waterford, Navan, Athlone, Castlebar, Sligo, Letterkenny, Tralee) and this rollout is continuing to further locations. It is envisaged that ComReg will further invest in this system during the lifetime of this strategy statement. In particular, additional monitoring nodes will be deployed in areas of high spectrum usage to further ComReg's capability to gather spectrum usage data and to detect sources of radio interference. In addition, recent advents in software defined radio has allowed ComReg to commence research and development into tailor-made solutions for long and short term monitoring as well as interference investigation. Whilst in its infancy, this is an area that is likely to grow in importance over time.

3.5.5 TEST AND TRIAL IRELAND

Ireland has a capability and reputation for research excellence in wireless innovation and technology.³³ There is an increasing base of enterprises and researchers engaging in wireless research activities covering the full continuum of research, from fundamental research to that of a more applied nature. In addition multi-national firms located here (such as Huawei Technologies Ireland and Intel Labs Europe) and other internationally-based companies (such as iDirect and VTT Technical Research Centre) continue to investigate and test new radio equipment products and/or conduct pre-launch service trials using Ireland's radio spectrum under Test and Trial Ireland.

ComReg promotes Ireland's strengths and opportunities in the wireless technology sector and the benefits associated with Test and Trial Ireland.³⁴ These opportunities arise primarily from Ireland's geographic position on the western edge of Europe and its low population density which provide a key natural advantage, namely, a relative abundance of unused radio spectrum. Test and Trial Ireland enables entrepreneurs, researchers and developers to test or trial wireless technologies in a wide variety of frequency bands, including key parts of the radio spectrum used by mobile and broadcasting sectors.

31 Decision No 768/2008/EC of the European Parliament and of the Council of 9 July 2008 on a common framework for the marketing of products, and repealing Council Decision 93/465/EEC.

32 Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93.

33 For example, the Royal Irish Academy's (RIA's) biennial Research Colloquium on Communications and Radio Science into the 21st Century showcases some of Ireland's wireless innovation expertise. ComReg under its Test and Trial Ireland regime supported the RIA's 17th Colloquium in 2014 and the Colloquium Proceedings CD is available from RIA, Academy House, Dawson Street, Dublin 2 ISBN: 978-1-908996-33-6.

34 For example in 2014 and 2015 ComReg promoted Test and Trial Ireland at relevant conferences on wireless innovation held in Dublin (such as at an SFI supported event the US-Ireland R&D Partnership Programme, which involves the Governments of the United States of America, Ireland and Northern Ireland working together to advance scientific progress by awarding grants to collaborative projects in telecommunications, amongst others, and also at the 12th European Co-operation in the field of Scientific and Technical Research meeting (COST IC2004) held in Dublin City University). Further details are set out at <http://www.testandtrial.ie/NewsDetails/21#.VhUm3Nq9KSM>.

3. INTRODUCTION TO SPECTRUM MANAGEMENT IN IRELAND

CONT.

Excellence in wireless research (technologies, products and/or services) is an enabler of competitiveness. Test and Trial Ireland can continue to play a role in Ireland's wireless innovation ecosystem and, to that end, ComReg works with fellow State agencies (particularly IDA Ireland, Science Foundation Ireland and Enterprise Ireland), Government, commercial organisations and research institutions to promote the benefits of Test and Trial Ireland to potential new clients.³⁵

For example, in 2013 and through our relationship with IDA Ireland, Test and Trial Ireland was used by a multi-national client that subsequently formed part of 1 of 54 company announcements made by IDA in the year. Similarly in 2014, 1 of 12 large scale SFI Research Centres, CONNECT, who partnered with another multi-national client used Test and Trial Ireland.³⁶

The fact that a number of world's first tests have been conducting using Test and Trial Ireland reflects well on ComReg's agenda for wireless innovation using Ireland's radio spectrum. For example, Test and Trial Ireland's clients conducted the world's first tests of TD-LTE in the 2.6 GHz band in a real world environment³⁷, cognitive radio and an Internet of Things backbone using TV whitespace spectrum.³⁸

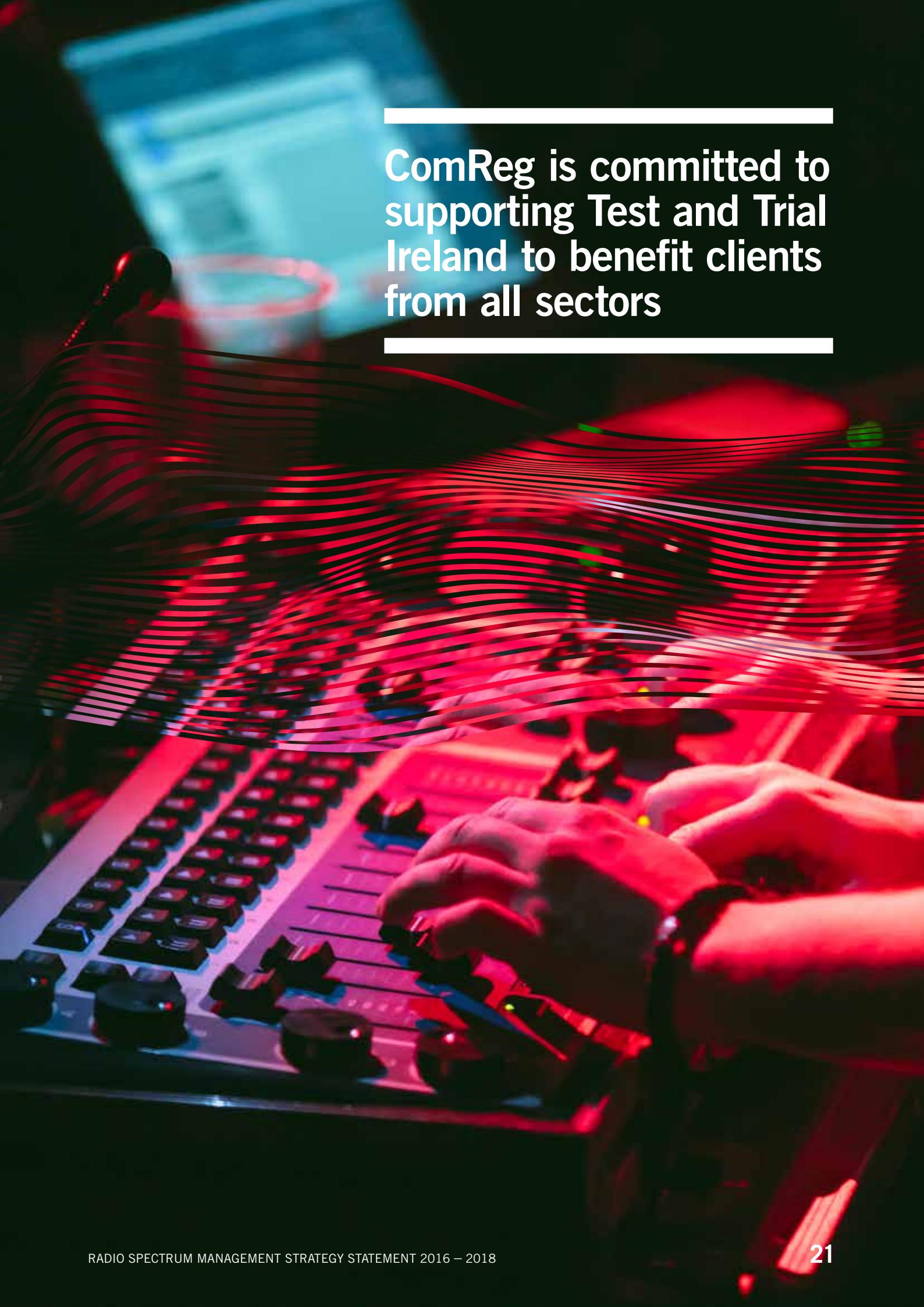
Having regard to future trends, including the increased demands for advanced mobile services, potential impacts of the internet of things ("IoT") and 5G, and new wireless opportunities associated with satellite communications, ComReg is committed to supporting Test and Trial Ireland to the benefit of returning and new Test and Trial Ireland clients from all sectors.

³⁵ For example, at Mobile World Congress 2015 one of ComReg's Test and Trial Ireland clients showcased at the Enterprise Ireland sponsored Ireland pavilion; Klas Telecom. Also in 2015 at the *Learnovate* (an IDA and EI funded Technology Centre) National Conference on EdTech "Enabling the knowledge economy" material distributed to attendees showcased ComReg's Science Technology in Action 2015 sponsorship of a teaching aid on "Radar and its Uses".

³⁶ <http://www.idaireland.com/newsroom/huawei-announces-the-open/>. In addition, in 2014 five new Research Centres were launched, with SFI funding of €155 million and €90 million in matching contributions from over 165 industry partners and ComReg has had linkages to CONNECT (The Centre for Future Networks & Communications, formerly the CTVR at Trinity College Dublin) who is a previous client of Test and Trial Ireland.

³⁷ http://www.testandtrial.ie/Real_world_tests/230

³⁸ http://www.testandtrial.ie/Research_/231 and http://www.testandtrial.ie/Year_in_review__2014_/238



ComReg is committed to supporting Test and Trial Ireland to benefit clients from all sectors

4. DEVELOPMENTS IN RADIO SPECTRUM USE SINCE 2011

In order to inform this radio spectrum management strategy, a number of significant developments in the management and use of the radio spectrum since 2011 have been considered, including:

- making more spectrum available for mobile wireless broadband services;
- the acquisition of Telefónica by Hutchison;
- the introduction of a spectrum transfer framework;
- the potential for further spectrum releases for mobile, nomadic and fixed wireless broadband services;
- the closure of the 13 and 15 GHz spectrum bands for new radio links licences in the congestion area of Greater Dublin;
- the switchover from analogue to digital terrestrial television; and
- broadcasting frequency planning in the UHF band since WRC-12.

Readers are referred to chapter 4 of Consultation 15/131 and chapter 2 of Document 16/49 for ComReg's consideration of these developments.

Noting the considerable developments relating to spectrum for mobile wireless broadband and the importance of the mobile consumer retail issue, this section highlights a number of the significant developments related to these matters since 2011.

4.1 SPECTRUM FOR MOBILE WIRELESS BROADBAND

4.1.1 THE 2012 MULTI-BAND SPECTRUM AWARD

In 2012 ComReg completed its Multi-Band Spectrum Award (MBSA) for the 800 MHz, 900 MHz and 1800 MHz bands. The MBSA successfully assigned all the long term spectrum rights of use in each of these bands to 2030, resulting in an additional 150 MHz of spectrum being assigned, almost trebling the amount of spectrum assigned in the sub 1 GHz bands (see Figure 3 opposite).

4.1.2 THE ROLLOUT OF IMPROVED 3G AND NEW 4G SERVICES

Following the grant of technology- and service-neutral Liberalised Use Licences in the 2012 MBSA process, new and improved services were quickly introduced alongside the continued provision of the existing 2G or GSM services.

For example, in 2013, 3G (or UMTS) services were expanded using the 900 MHz bands³⁹ and 4G (or LTE) services were also introduced to the market in that year.

ComReg observes that technology- and service-neutral licensing facilitated this innovation by providing flexibility to the licensees in deploying the appropriate technology to best meet end-user demands.

³⁹ For example, Meteor's website indicates that its 3G speeds have increased 70% www.meteor.ie/ournetwork/ (16 September 2015)

FIGURE 3: THE PRE- AND POST-MBSA SPECTRUM ASSIGNMENTS

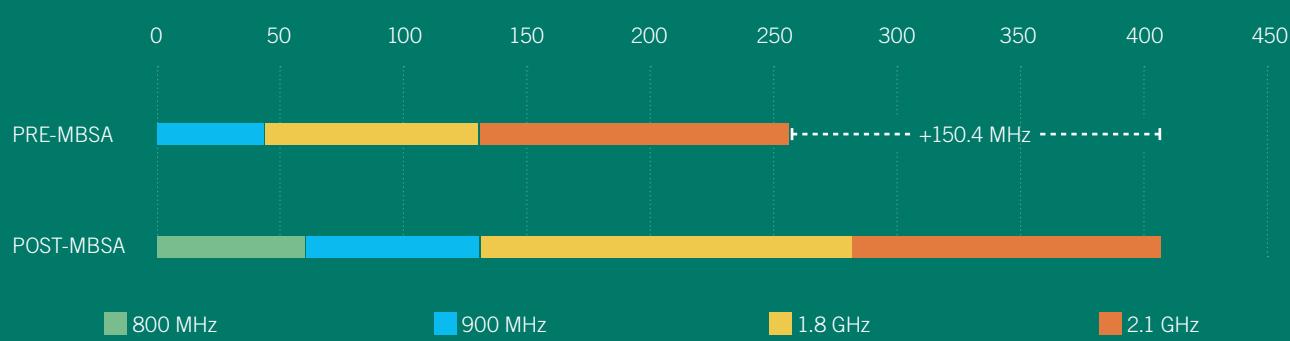
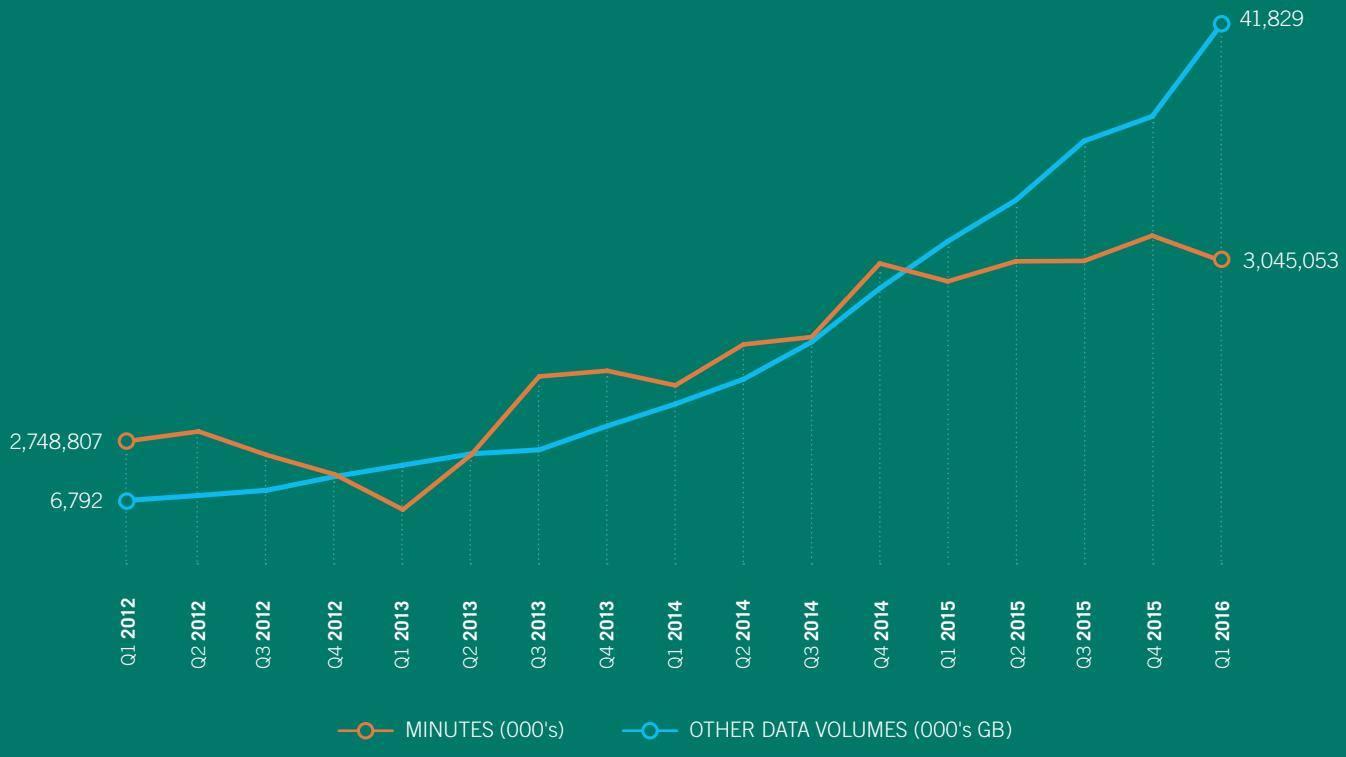


FIGURE 4: TREND OF VOICE AND MOBILE DATA VOLUMES Q1 2012 TO Q1 2016



SOURCE: QUARTERLY KEY DATA QUESTIONNAIRE

**Between 2015 and
2035, user demand
for mobile data will
increase 33 times**

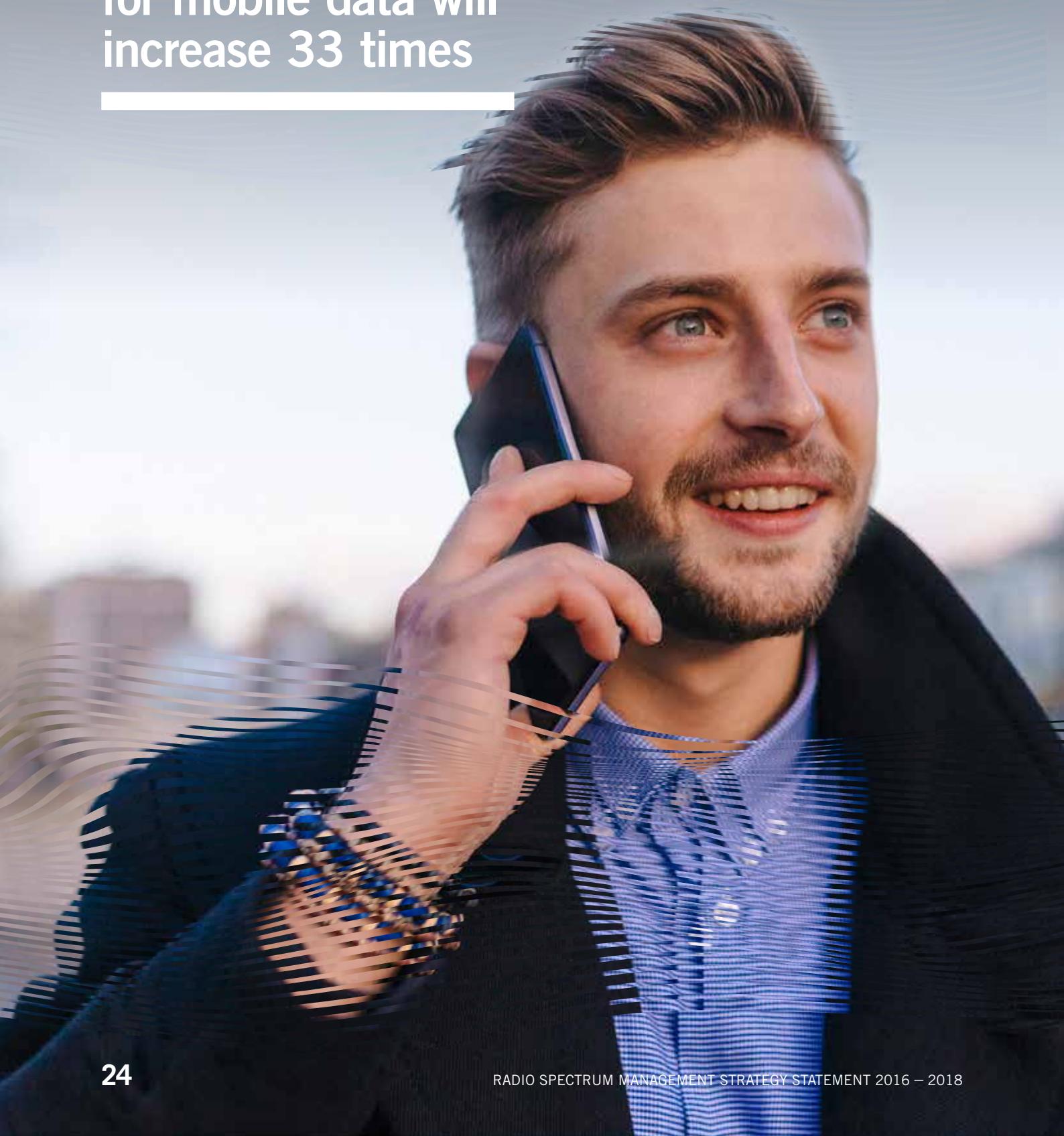
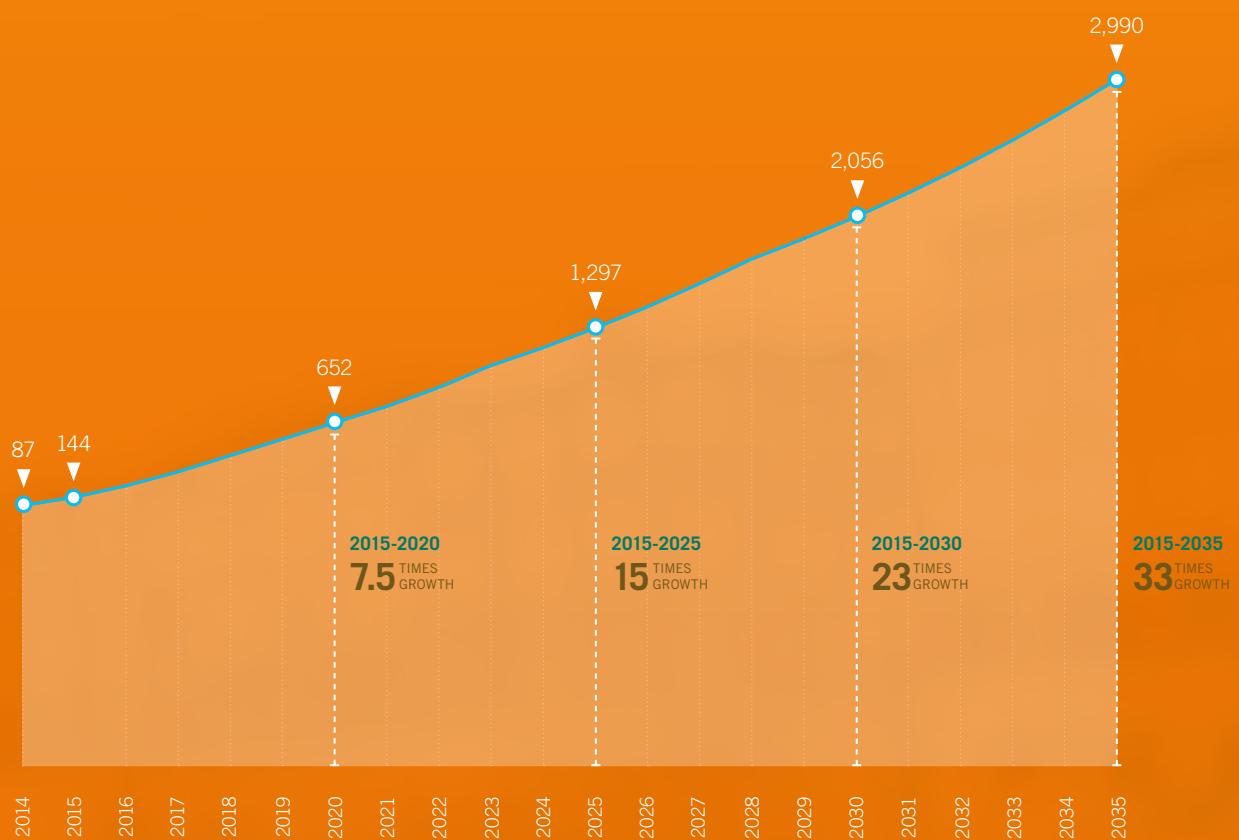


FIGURE 5: PREDICTED TOTAL MOBILE DATA USAGE PER YEAR (MILLION GB), FRONTIER CBA (MEDIUM DEMAND SCENARIO)



4. DEVELOPMENTS IN RADIO SPECTRUM

USE SINCE 2011

CONT.

4.1.3 MOBILE DATA USAGE IS INCREASING

Since 2012, data usage on the mobile networks has increased significantly. While mobile voice services have increased by over 10% in the period Q1 2012 to Q1 2016, mobile data usage has increased by over 500% (see Figure 4 on previous page).

Further, as of Q1 2016, the average traffic per smartphone user reached 2.7 GB of data per month, while the average traffic per dedicated mobile broadband subscriber was 7.4 GB of data per month. This represents a 69% year-on-year increase for smartphone usage and a 7% year-on-year increase for mobile broadband usage. In the same period in 2012, the average traffic per smartphone user was 300 MBs of data per month and 2.8 GBs per month for mobile broadband per month.

These increases are likely due to a number of factors including:

- increased 3G and 4G network capability and coverage;
- increased smartphone penetration - currently around 84% of all mobile subscriptions (excluding dedicated mobile broadband and M2M)⁴⁰;
- rising mobile data caps, and “all you can eat” plans; and
- the increasing use of video and over-the-top (OTT) applications.

User demand for mobile data is expected to further increase due to increased penetration and capability of devices (particularly 4G smartphones). A 2015 report for ComReg by Frontier Economics conservatively estimated that, between 2015 and 2035, user demand for mobile data will increase 33 times⁴¹ as illustrated in Figure 5 opposite.

PARADIGM SHIFT: MOBILE SMARTPHONE USE CASE

Future mobile data traffic is expected to grow significantly due to mainly, though not only, the developments in the mobile smartphones, which is linked to the increasing consumption of mobile internet and smart apps by end users.⁴²

With increased penetration and use of smartphones, it appears that end-users increasingly expect to access mobile internet/video services at any time and place similar to the service enjoyed with voice calls in terms of nationwide access. In addition it appears that smartphone users increasingly expect to access mobile internet/video services with service levels similar to those enjoyed in the home / Wi-Fi hotspot in terms of data speeds and reliability.

To meet these expectations, the delivered speeds and capacity of dedicated mobile networks will need to continue to evolve over time, and the deployment of technology advances, such as carrier aggregation, will increasingly be required.⁴³

4.1.4 THE ACQUISITION OF TELEFÓNICA BY HUTCHISON

On 1 October 2013, Hutchison 3G UK Holdings Limited (Hutchison) notified the European Commission (EC) of its then proposed acquisition of Telefónica Ireland Limited (Telefonica). The EC then commenced an investigation into the proposed acquisition and ComReg extensively engaged with the EC in relation to its investigation.⁴⁴

On 28 May 2014, the EC announced that it had decided to conditionally approve the proposed acquisition on the basis of the commitments put forward by Hutchison⁴⁵ in response to the competition concerns identified by the EC.⁴⁶

⁴⁰ ComReg Quarterly Report Q1/16 (Document 16/48). This represents the mobile voice and data subscribers using 3G/4G networks in Ireland, and can be taken as an indication of the number of smartphone users (page 54).

⁴¹ See ComReg Document 15/62a on a cost benefit analysis of the change of use of the 700 MHz radio frequency band in Ireland.

⁴² At an event on understanding the mobile consumer (IAB Ireland Mobile Connect 2015) on Insights into Ireland's Mobile Media usage data about how Irish consumers are engaging with content on smartphones, tables showed that in the twelve months from August 2014 to August 2015 there was a 66% increase in smartphone page views compared to a -4% decrease in desktop page views for Daily Mail / Mail online publication. <http://www.comscore.com/Insights/Presentations-and-Whitepapers/2014/Understanding-the-Mobile-Consumer>.

⁴³ For example, in the early 2000s mobile EDGE using 200kHz provided for circa 470kbps downlink and uplink whereas in 2015 LTE-A Release >10 using 20MHz provides the potential for 1 Gbps downlink and 100Mbps uplink.

⁴⁴ Case M.6992 http://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=2_M_6992

⁴⁵ In summary Hutchison committed to:

- offering to Eircom to continue the existing network share agreement (between Meteor and O2) on improved terms;
- providing wholesale access to Three's network to two MVNOs on the basis of “capacity agreements” in return for fixed payments;
- and offering to one of the two MVNOs (but not both) the option to acquire certain spectrum rights of use to enable one or the other to become a MNO.

The option will be available for 10 years starting from 1 January 2016.

Commitments available at: http://ec.europa.eu/competition/mergers/cases/additional_data/m6992_4894_3.pdf

⁴⁶ The EC's full decision, among other things, states (at para 688):

“The Commission considers that the change in spectrum holdings resulting from the merger is unlikely to have anticompetitive effects. The merger will not reduce the spectrum holdings of Eircom and Vodafone and, hence, it will not have any impact on the network quality and speed offered by Eircom and Vodafone. The fact that, after the merger, there will be a spectrum asymmetry is not, as such, anticompetitive.”

While fully respecting the EC's position as the decision-making body for the assessment of the proposed acquisition, ComReg stated (in Document 14/53) that it remains concerned that, given the substance and form of the Final Commitments, the EC's competition concerns will not be fully addressed, and that significant negative consequences for Irish consumer welfare may result.

Further ComReg stated that in keeping with its statutory powers it would:

- › *"monitor the competitive dynamic of the mobile markets affected; and*
- › *proceed with its strategy for managing the radio spectrum including the identification of other spectrum releases in order to promote competition and further promote innovation and network investment, among other things."*

POST-ACQUISITION DEVELOPMENTS

ComReg observes that it remains premature to draw any conclusions on the outcome of the above acquisition in relation to competition in the relevant mobile markets because, among other things, Three's integration of the former separate businesses is still ongoing and the two mobile virtual network operators (MVNOs) envisaged under the Final Commitments have only recently entered the market⁴⁷, the impact of which remains to be seen.

4.1.5 MOBILE COVERAGE

Each of the MNOs provide online maps showing their respective mobile coverage. All MNOs claim nationwide outdoor population coverage for the existing 2G services (i.e. voice and text), while the 3G and 4G outdoor coverage of each MNO varies; 3G outdoor coverage is generally greater than 90% of the population; and for 4G outdoor coverage Vodafone claims over 90% population coverage

in every county of Ireland⁴⁸, eircom claims 67% population coverage⁴⁹ and plans to extend its coverage to over 90% of the population by December 2016⁵⁰, and Three is extending its 4G network⁵¹.

ComReg also observes that 4G coverage in Ireland has been rolled out rapidly (noting that some MNO's 4G coverage has been rolled out faster than others) and, compared to other EU countries, Ireland's 4G coverage of 90% population for June 2015 is above the EU average of 86% population coverage⁵².

ComReg further observes that each MNO's claimed outdoor coverage is well in excess of the technology- and service-neutral coverage obligation of 70% of the population as detailed in the Liberalised Use licences granted on foot of the MBSA process.⁵³

COMREG'S DRIVE TESTING PROGRAMME FOR MOBILE NETWORKS

ComReg monitors and supervises compliance by all of the MNOs with the conditions attached to their respective licences. In relation to their coverage obligations, ComReg carries out comprehensive drive test measurements to provide a snapshot of how their respective networks performed in relation to their licence obligations throughout the test duration and for the test route that was driven.

The drive testing exercises which ComReg carried out in mid-2015 and winter 2015 are detailed in ComReg Documents 15/142R1⁵⁴ and 16/27⁵⁵ respectively. In these documents, ComReg presents, among other things, its finding that "*All networks measured were found to be compliant with the licence conditions in force.*" (para 10).

⁴⁷ Dixons Carphone Warehouse (20 August 2015) and Virgin mobile (5 October 2015)

⁴⁸ <http://www.vodafone.ie/network/> (8 July 2016)

⁴⁹ eircom Fourth Quarter and Full Year Results (September 1, 2015)

⁵⁰ eir 3rd quarter results presentation to 31 March 2016 (29 April 2016)

⁵¹ Three, Ireland's leading mobile data network, introduces free 4G for life (Press Release 23 March 2016)

⁵² See slide 14 of Broadband market developments in the EU 2016 (http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=15807) (Digital Agenda Scorecard 2015) (<https://ec.europa.eu/digital-agenda/download-scoreboard-reports>)

⁵³ This suggests to ComReg that mobile coverage is driven primarily by competitive forces and, in this regard, ComReg notes that each MNO uses coverage as a factor by which to attract and retain customers.

⁵⁴ http://www.comreg.ie/_fileupload/publications/ComReg1542R1.pdf

⁵⁵ http://www.comreg.ie/_fileupload/publications/ComReg1627.pdf

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4.2 THE MOBILE RETAIL CONSUMER EXPERIENCE & COMREG'S CURRENT THINKING

Despite the improvements in mobile networks with the rollout of improved 3G and new 4G mobile services, and ComReg's 2015 ICT consumer survey which indicated that 90% of mobile phone users are satisfied with their service (up from 76% in 2013⁵⁶) there is a public perception that the mobile consumer experience has deteriorated^{57 58}.

POTENTIAL FACTORS CONTRIBUTING TO THE PERCEPTION THAT THE MOBILE RETAIL CONSUMER EXPERIENCE HAS DETERIORATED

ComReg observes there may be various factors contributing to the perception that the mobile retail consumer experience has deteriorated, including:

- the increased use of mobile phones with poorer antenna sensitivity performance noting, in this regard, that:
 - the performance of a mobile phone depends on its ability to collect a mobile signal; and
 - studies carried out for the Danish Business Authority indicate that there is considerable variation in the antenna sensitivity performance of mobile phones - with some of the most popular smartphones being at the bottom of the performance list tested;⁵⁹
- changing consumer habits and expectations. Given consumers' increasing consumption of 3G and 4G mobile data services, they may now expect such services to be provided on a nationwide basis similar to that of voice and text (i.e. 2G) services;
- the difference between outdoor and indoor signal level, noting that this can often vary substantially and that this may deteriorate indoors (compared to outdoors) depending on the technology (2G or 3G) and the network operator⁶⁰;
- that, when compared to low data rate or voice services, the reception of higher data services and applications is more susceptible to swifter degradation in areas where the signal is weak. This could lead to the perception that the mobile consumer experience has deteriorated, particularly in the context of an increasing consumption of higher data rate mobile data services (e.g. video);
- the integration of new services into mobile networks (e.g. 3G into the 900 MHz band and 4G into the 1800 MHz band) and the effect this may have on existing services (e.g. 2G services);
- the post-acquisition activities of Three to integrate the networks of Hutchison and Telefónica⁶¹;
- the use of better building insulation materials (e.g. window insulation/tinting, foil backed insulation) and the consequent reduction in indoor signal penetration; and
- the ability of the MNOs to find suitable sites and/or obtain planning permission for same by which to provide increased network coverage and/or capacity.^{62 63}

⁵⁶ See Page 63 of http://www.comreg.ie/_fileupload/publications/ComReg15123a.pdf

⁵⁷ See debates in Joint Oireachtas Committee on Transport and Communications

- Electronic Communications Services: Commission for Communications Regulation - 27 January 2016; and
- Mobile Telephone Coverage and High Speed Broadband Availability: Discussion - 12 November 2014 and 8 October 2014 and associated press release.

⁵⁸ See ComReg's Consumer Line Statistics for Q3 2015 (Document 15/122), Q4 2015 (Document 16/08) and Q1 2016 (Document 16/38, and in particular paragraphs 15 and 16).

⁵⁹ See for example:

- Mobile Phone Antenna Performance 2013 Pedersen, Gert F (Aalborg University); and
- Limit values for Downlink Mobile Telephony in Denmark. Pedersen, Gert F. (Aalborg University).
- Technical support relating to performance of antennas of mobile phones -Eurexem Engineering (January 2014) – Study for the European Commission - Enterprise and Industry Directorate-General
- Mobile handset testing report commissioned by Ofcom (November 2015) <http://stakeholders.ofcom.org.uk/market-data-research/other/technology-research/2015-reports/mobile-handset-testing/>

⁶⁰ See paragraph 90, ComReg Document 16/31, published 4 May 2016.

⁶¹ See for example 'Coverage is getting worse, not better,' says Coleman – 19 May 2016, <http://www.southernstar.ie/news/roundup/articles/2016/05/19/4119711-coverage-is-getting-worse-not-better-says-coleman/>

⁶² See, for example:

- Economic Social Research Institute (ESRI) working paper No. 401 of 2011. Gorecki P., Hennessy H., Lyons S., "How impact fees and local planning regulation can influence deployment of telecoms infrastructure".
- "Want better mobile coverage? Then stop rejecting phone masts" 22 November 2015, <http://www.independent.ie/business/technology/news/want-better-mobile-coverage-then-stop-rejecting-phone-masts-34221604.html>

⁶³ "Three Ireland ordered to remove Dublin phone mast" 20 May 2016, <http://www.irishtimes.com/business/retail-and-services/three-ireland-ordered-to-remove-dublin-phone-mast-1.2654020>

POTENTIAL FACTORS CONTRIBUTING TO THE PERCEPTION THAT THE MOBILE RETAIL CONSUMER EXPERIENCE HAS DETERIORATED

THE INTEGRATION OF NEW SERVICES INTO MOBILE NETWORKS (E.G. 3G INTO 900 MHZ, 4G INTO 1800 MHZ).

THE INCREASED USE OF PHONES WITH A POORER ANTENNA PERFORMANCE.

THE ABILITY OF MOBILE PHONE OPERATORS TO FIND SUITABLE SITES OR OBTAIN PLANNING PERMISSION.

CHANGING CONSUMER HABITS AND EXPECTATIONS (E.G. INCREASED USE OF DATA, GREATER RELIANCE ON PHONE).

THE USE OF BETTER BUILDING INSULATION MATERIALS (E.G. FOIL BACKED PRODUCTS) REDUCING THE INDOOR SIGNAL STRENGTH.

HIGHER DATA SERVICES BEING MORE SUSCEPTIBLE TO SWIFTER DEGRADATION WHERE THE SIGNAL IS WEAK.

POTENTIAL MEANS OF ADDRESSING THE MOBILE RETAIL CONSUMER EXPERIENCE

BETTER INFORMING CONSUMERS, E.G. ON THE EXPECTED MOBILE COVERAGE OF ALL MOBILE NETWORKS, OR HOW ANTENNA PERFORMANCE MAY VARY.

READY AND TIMELY ACCESS BY MNOS TO ADDITIONAL SITES BY WHICH TO PROVIDE INCREASED COVERAGE.

THE USE OF MOBILE REPEATERS TO ADDRESS INDOOR RECEPTION ISSUES.

THE INTRODUCTION OF REQUIREMENTS ON RECEIVER PERFORMANCE STANDARDISED AT A EUROPEAN OR GLOBAL LEVEL.

THE ABILITY TO USE FIXED BROADBAND CONNECTIONS (E.G. NATIVE WI-FI CALLING) TO PROVIDE MOBILE SERVICES TO ADDRESS INDOOR RECEPTION ISSUES.

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4.2.1 COMREG'S CURRENT THINKING

This is now an issue of national importance as highlighted by the following priority set out in the programme for Government⁶⁴:

"Within 100 days, we will establish a mobile phone and broadband taskforce to provide immediate solutions to the broadband/phone coverage deficit, involving the Department of Communications, the Department of Environment, the Department of Transport, ComReg, the telecommunications industry and consumers, to investigate how to provide better services for consumers including better use of State assets."

Having regard to the above, ComReg's preliminary views in section 7.8 of Consultation 15/131, ComReg's assessment of respondents' views in sections 3.3 and 4.8 of Document 16/49, and other relevant information, ComReg is of the view that address this issue will form an important part of ComReg's spectrum work plan activities for the period 2016 to 2018.

Given the diverse range of factors as discussed above that may be affecting the mobile consumer experience, ComReg considers that a better understanding of these and any other relevant factors and the nature and extent of their respective impact on the consumer experience is the first step in this process.

ComReg observes that this approach would facilitate an informed discussion and ensure that the full range of potential measures are identified and appropriately considered for action. ComReg further observes that various parties, both public and private including the MNOs, may have a role to play in addressing this matter.

POTENTIAL MEANS OF ADDRESSING THE MOBILE RETAIL CONSUMER EXPERIENCE

Given the variety of potential factors, ComReg notes there may be various ways of addressing this matter including:

- better informing consumers, for example, on the expected mobile coverage of all mobile networks⁶⁵, or on how the antenna performance of mobile phones can vary and how this can affect the consumer experience. This would enable consumers to make the best choices in light of their particular needs and circumstances;
- the introduction of requirements on receiver performance. Given that mobile phones are manufactured for regional or global markets, ComReg observes that, for this to be effective, such requirements would need to be standardised at a European and, ideally, a global level. This is currently being developed by ETSI as part of its work on updating standards for products that fall within the scope of the new Radio Equipment Directive⁶⁶;
- ready and timely access by MNOs to additional sites by which to provide increased coverage, noting that such sites could be macro sites to provide wide area coverage or other sites, such as microcells, picocells, femtocells etc. to target specific areas for coverage and/or capacity;
- the use of mobile repeaters to address indoor reception issues, noting that such repeaters would have to be CE-certified and be authorised (via a licence or a licence-exemption) to use the radio frequencies⁶⁷; and
- the ability to use fixed broadband connections (e.g. native Wi-Fi calling⁶⁸) for the provision of mobile services (both voice and data) to address indoor reception issues.

⁶⁴ http://www.merrionstreet.ie/MerrionStreet/en/ImageLibrary/Programme_for_Partnership_Government.pdf

⁶⁵ ComReg observes that Ofcom maintains a mobile broadband and coverage checker. <http://maps.ofcom.org.uk/check-coverage/>

⁶⁶ See also Commission implementing decision 4.8.2015 M/536 (and Annex II 3. (2) therein) here <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32014L0053> and Directive 2014/53/EU here <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0053&from=EN>.

⁶⁷ In March 2016 Ofcom published a summary of call for input responses and recommended next steps titled "Improving mobile coverage - Enabling the benefits of consumer installed mobile repeaters" <http://stakeholders.ofcom.org.uk/consultations/mobile-coverage-enhancers/statement/>

⁶⁸ For example:

- Wi-Fi Calling Finds Its Voice – Ericsson (July 2015)

- Make a call with Wi-Fi Calling - Apple Support (31 May 2016) and Wireless carrier support and features for iPhone in Europe



ComReg will endeavour to get a greater understanding of the issues and seek solutions which can deliver improved outcomes and to support the proposed Government Task Force on both rural and mobile coverage

5. DEMAND FOR RADIO SPECTRUM

A wide range of factors affect the demand for and the supply of radio spectrum including: end-user demand, technology changes or advancements, the international harmonisation of radio spectrum, and relevant national or international policies.

5.1 BACKGROUND

These general factors also influence each other. For example, increasing end-user demand for a service incentivises advancements in technologies used to provide these services and the development of international harmonisation measures or national/international policies, and vice versa.

END-USER DEMAND

The expectations and demands of end-users change over time and this will affect the demand of a radio service for spectrum. Some services revise their demand for radio spectrum on a frequent basis while others do not.

For example:

- the increased end-user demand for real-time global flight tracking of aircraft resulted in an allocation of radio spectrum as agreed at WRC-15⁶⁹; and
- the demand for spectrum for mobile wireless broadband has been revised upwards in recent years⁷⁰ and, as a result, the RSPP Decision seeks to identify at least 1200 MHz of suitable spectrum by 2015.⁷¹

TECHNOLOGY CHANGES AND ADVANCEMENTS

Technology changes⁷² and advancements can affect both the demand for and supply of radio spectrum. Under normal circumstances such changes lead to a more efficient use of

FIGURE 6: BACKGROUND FACTORS AFFECTING SUPPLY AND DEMAND FOR RADIO SPECTRUM



⁶⁹ With significant contributions from Ireland at the WRC and the preceding Conference Preparatory Meeting (CPM15-2), an allocation for global flight tracking in civil aviation was agreed at WRC-15. http://www.itu.int/net/pressoffice/press_releases/2015/51.aspx#.VkTH8mcnxUQ

⁷⁰ In an Irish context, ComReg notes that smartphone users are now consuming approximately nine times more mobile data services compared to four years ago. As of Q1 2016, the average traffic per smartphone user was 2.7 GB of data per month. In 2012, this figure was 300 MBs per month.

⁷¹ Decision No 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy programme.

the radio spectrum and in some instances this can result in faster or higher quality services being provided which may be sufficient to address an increasing end user demand for services. In other instances this can result in spectrum being released from one service to another.⁷³

Technology advancements can take many forms including the use of improved modulation or sharing techniques and the ability for one service to use multiple spectrum bands at the same time, including:

- the use of carrier aggregation for mobile services - where multiple spectrum carriers (both intra-band and inter-band) can be used simultaneously by a single user; and
- the use of geolocation, white space and cognitive techniques to improve the sharing of spectrum between services.

INTERNATIONAL HARMONISATION OF RADIO SPECTRUM

The international harmonisation process plays a key role in determining the demand for and the supply of radio spectrum, given its benefits in terms of facilitating economies of scale in the manufacture of radio equipment (which lowers both the cost of deploying wireless networks and the cost of wireless devices for consumers) and the minimisation of interference between users.

International harmonisation, and benefits provided from same, is particularly important for countries with a small population, such as Ireland, and, therefore, limited ability to affect the technology roadmaps adopted by often global suppliers of radio equipment.

In ComReg's experience, the appropriate release of harmonised spectrum bands has proven to be generally very successful in facilitating the delivery of services to end-users.⁷⁴ On the other hand, the release of non-harmonised spectrum bands has proven to be less successful.⁷⁵

Harmonised radio spectrum measures are set by a number of bodies including the ITU (and/or the constituent regional groups), the CEPT and the EU bodies. These bodies also generally set a forward looking work programme which can provide an indication of future harmonisation measures. Relevant work plan examples include those of CEPT⁷⁶ and RSPG.⁷⁷ In some instances, harmonisation decisions are obligatory on EU Member States, thereby directly increasing the supply of spectrum at a national level with a defined timeframe.⁷⁸

In addition to the harmonisation of radio spectrum bands, the setting of harmonised radio equipment standards play a major facilitating role in spectrum management, particularly in terms of minimising the risk of interference between users. Within Europe, the main stakeholders responsible for setting these standards are the European Committee for Standardisation (CEN), the European Committee for Electrotechnical Standardisation (CENELEC) and the European Telecommunications Standards Institute (ETSI). These bodies also work alongside national technical committees and various industry bodies. For example, the Institute of Electrical and Electronics Engineers (IEEE) and the WiMAX Forum.⁷⁹

⁷² Technology changes happen on a less frequent basis than technology advancements. For example, the free-to-air analogue terrestrial television technology operated for over 50 years in Ireland before this technology was replaced by the free-to-air digital terrestrial television technology.

⁷³ For example, the ASO in 2012 allowed both more TV programme services to be delivered to Irish viewers and released the 800 MHz band for terrestrial networks capable of providing ECS and, in particular, mobile wireless broadband services.

⁷⁴ In Ireland, harmonised spectrum bands support a wide range of services, for example the services provided by the mobile network operators. However, there are also harmonised spectrum bands where no services are currently provided. For example, the 1980-2010 / 2170-2200 bands harmonised at an EU level for Mobile Satellite Services (MSS).

⁷⁵ For example, ComReg observes that no commercial services have been deployed in 400 MHz and 900 MHz bands licensed using the Wideband Digital Mobile Data Services (WDMDS) licences which were issued 10 years ago in 2005.

⁷⁶ For example, the ECC CEPT work plan for 2015 to 2020 identifies the following major topics:
- Implementation of a new digital dividend in the 700 MHz band;
- Spectrum for wireless broadband (including 5G);
- Responding to the needs of short range devices including appropriate spectrum access for the internet of things (IoT);
- Programme Making and Special Events (PMSE); and
- Public Protection and Disaster Relief (PPDR).

⁷⁷ The draft RSPG work programme for 2016 and beyond has identified the following work items:
- Digital Single Market – Telecoms Regulatory Framework issues
- Spectrum related aspects for next-generation wireless systems (5G)
- Internet-of-things (IoT) including M2M and ITS; and
- WRC-19 preparation (common policy objectives for WRC-19).

⁷⁸ In Europe, EU/EC decisions are obligatory on member states, while CEPT decisions are non-binding and voluntarily adopted by its members.

⁷⁹ IEEE802.16a is the technical reference for the fixed wireless WiMax standard promoted by this Forum.

5. DEMAND FOR RADIO SPECTRUM

CONT.

INTERNATIONAL AND NATIONAL POLICIES

At a European level, the Europe 2020 growth strategy⁸⁰ (from which the Digital Agenda for 2020 is one of the 7 flagship initiatives) sets a number of targets for EU Member States, including high level targets related to energy sustainability and specific targets related to the widespread provision of high speed broadband.

Such policies can increase the demand for specific services (e.g. smart metering or wireless broadband), or change the attractiveness of deploying ancillary services (e.g. IoT devices in homes may become more popular with high speed broadband), thereby influencing spectrum management actions at a national level.

In Ireland, the National Broadband Plan (NBP) is a Government policy initiative which aims to bring high speed broadband to every citizen and business in Ireland. The DCENR is currently in the process of finalising its intervention strategy. The NBP intervention strategy aims to achieve 100% access to high speed broadband in the intervention area⁸¹ and it is the intention that a contract or contracts be signed by June 2017.⁸²

The delivery of high speed broadband to every citizen and business in Ireland will improve Ireland's connectivity and this in turn can increase the demand for radio spectrum usage within homes and business. For example, via the increased use of connected devices or WiFi offloading. The delivery of the NBP may also result in improved backhaul connectivity within the country and this could assist the development of wireless networks, for example by providing new backhaul locations that could increase network coverage and capacity.

5.2 SPECIFIC RADIO SPECTRUM DEMAND

Having considered the general factors that affect the radio spectrum environment, section 5.2 of Consultation 15/131 set out ComReg's draft consideration of the demand for spectrum for the following radiocommunication services within the next 5 years:

- mobile, nomadic and fixed wireless broadband services;
- broadcasting services;
- radio links services;
- business radio (including PPDR and PMSE) services;
- short range devices (including IoT) services;
- satellite services;
- radio amateur services; and
- aeronautical, defence maritime and scientific services.

The views of interested parties on these draft considerations and ComReg's assessment of same is set out in chapter 2 of Document 16/49.

While readers are referred to Document 16/49 and Consultation 15/131 for ComReg's more detailed consideration of the potential radio spectrum demand of radiocommunication services, the following provides details on two particular items.

5.2.1 THE FUTURE USE OF THE 700 MHz BAND

At WRC-12⁸³, an alternative allocation for the 700 MHz band (694 MHz to 790 MHz) was resolved giving the mobile service (excluding aeronautical) co-primary status with broadcasting. This allocation came into effect on 28 November 2015.

On 2 February 2016, the EC submitted a proposal for a decision by the EU Council and Parliament on the 470-790 MHz band⁸⁴ that by 30 June 2020 Member States would be required to allow the use of the 700 MHz band for terrestrial systems capable of providing wireless broadband electronic communications services only under harmonised technical conditions set by the EC.

⁸⁰ http://ec.europa.eu/europe2020/index_en.htm

⁸¹ <http://www.dcenr.gov.ie/communications/Lists/Publications%20Documents/Updated%20Strategy%20December%202015.pdf>

⁸² "The National Broadband Plan will be the most significant investment in rural Ireland since electrification" - Denis Naughten TD - Dublin, Monday 23rd May 2016

⁸³ WRC-12 is the acronym for the World Radiocommunications Conference held in Geneva in 2012.

⁸⁴ Decision of the European Parliament and of the Council on the use of the 470-790 MHz frequency band in the Union, (SWD(2016) 19 final), (SWD(2016) 20 final). <https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-43-EN-F1-1.PDF>

On 11 March 2016, Ofcom published updated 700 MHz proposals⁸⁵ which included bringing forward the date at which the 700 MHz band would be available in the United Kingdom for ECS by up to 18 months - to a target of no later than Q2/2020;

On 28 April 2016, a EC implementation decision on the harmonisation of the 700 MHz band for terrestrial systems capable of providing wireless broadband electronic communications services was adopted into law ; and

On 29 April 2016, the administrations of Belgium, France, Germany, Ireland, Luxembourg, the Netherlands and the United Kingdom entered into a multilateral agreement relating to the DTT plan for the 470-694 MHz band, as facilitated by the Western European Digital Dividend Implementation Platform (WEDDIP) group.⁸⁶

Significant preparations have been also completed by ComReg, in collaboration with 2RN and the BAI, on a technical frequency plan to relocate DTT below the 700 MHz band and the international coordination of same with the UK and France. In relation to the latter:

- in April 2016 a DTT co-ordination agreement was signed with France⁸⁷; and
- in relation to the UK it is ComReg's intention that:
 - the frequency plan for DTT below the 700 MHz band will be finalised and co-ordinated by July 2017; and
 - the frequency plan to enable the transition of DTT to below the 700 MHz band will be finalised and co-ordinated by Q4 2016.

The DTT frequency plan below the 700 MHz band allows relevant stakeholders to make practical arrangements (e.g. equipment procurement) for the repurposing of the 700 MHz band including the identification of a repurposing date. While Ireland has not yet finalised these considerations, it is ComReg's understanding that Ireland's 700 MHz migration activities are indicatively planned for the time period 2019/2020 (i.e. a period of 3-4 years from now)

5.2.2 COMREG'S PROPOSALS TO RELEASE ADDITIONAL SPECTRUM FOR MOBILE, NOMADIC AND FIXED WIRELESS BROADBAND

At an international level, harmonisation measures have recently been adopted by CEPT (e.g. 700 MHz, 1.4 GHz, 2.3 GHz) and the EC (e.g. 700 MHz, 1.4 GHz) to identify and make available more harmonised radio spectrum that can be used for mobile wireless broadband. Further harmonisation measures are also expected (e.g. an EU decision on the 700 MHz band).⁸⁸ The timely implementation of these harmonisation measures in Ireland, alongside other earlier harmonised bands such as the 2.6 GHz and 3.6 GHz bands, is likely to be sufficient to address the demand for mobile wireless broadband at least in the short-to-medium 5 year term.

For illustrative purposes, Figure 7 overleaf details the total amount of harmonised radio spectrum that could be made available by ComReg should it continue to progress the proposed awards initially discussed in Documents 15/140, 15/70 and 14/101.⁸⁹ This serves to highlight that an additional 740 MHz of spectrum could be made available for ECS/ECN which would almost treble the amount of spectrum from its current total of 405 MHz (i.e. the post-MBSA assignments).

As set out in chapter 6 below, ComReg's spectrum work plan for the period 2016 to 2018 aims to complete the award of the 3.6 GHz band significantly in advance of 31 July 2017 and to further progress its award proposals for the 700 MHz, 1.4 GHz, 2.3 GHz and 2.6 GHz bands within the timeframe of this spectrum management strategy.

⁸⁵ <http://stakeholders.ofcom.org.uk/binaries/consultations/maximising-benefits-700-MHz-clearance/summary/maximising-benefits-of-700MHz-clearance.pdf>

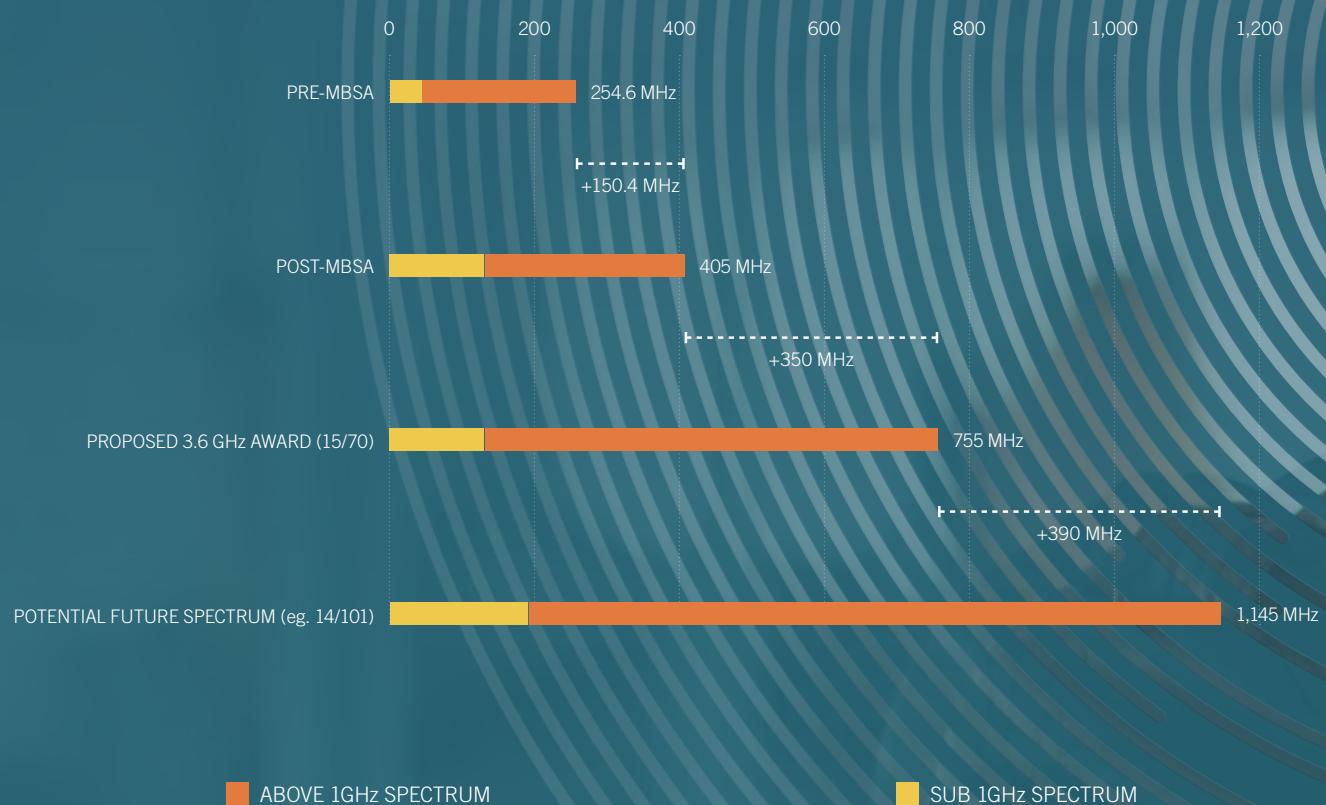
⁸⁶ http://www.anfr.fr/fileadmin/mediatheque/documents/coordination/Accords_par_pays/WEDDIP_statement_700_MHz_band_release.pdf

⁸⁷ http://www.anfr.fr/fileadmin/mediatheque/documents/coordination/Accords_par_pays/IRL-F_UHF_Agreement_20160428_signed.pdf

⁸⁸ On 2 February 2016, the EC submitted a proposal for a decision by the EU Council and Parliament on the 470-790 MHz band. <https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-43-EN-F1-1.PDF>

⁸⁹ Interested parties may note that there are a great number of facts and considerations to be finalised before any definitive positions are reached in respect of the particulars of such future award(s) and such extensive considerations are likely to be the subject of public consultations as appropriate.

FIGURE 7: TOTAL AMOUNT OF HARMONISED SPECTRUM FOR MOBILE, NOMADIC AND FIXED WIRELESS BROADBAND SERVICES UNDER COMREG'S PROPOSED AWARD PROCESSES OF DOCUMENTS 15/140, 15/70 AND 14/101





An additional 740 MHz of spectrum could be made available for ECS/ECN which would almost treble the amount of spectrum from the current total of 405 MHz

6. RADIO SPECTRUM WORK

PLAN FOR 2016 TO 2018

In light of the matters discussed in the preceding chapters and the consideration of the respondents' views to Consultation 15/131 as set out in Document 16/49, this chapter sets ComReg's radio spectrum work plan for the period 2016 to 2018.

ComReg's spectrum work plan has had regard to ComReg's envisaged spectrum workload, including licences that are due to expire over the next six years (i.e. up to 2021)⁹⁰ and the need for appropriate prioritisation of spectrum activities.

6.1 BACKGROUND

As spectrum is a finite and valuable resource, it must be managed in an effective manner so that efficient use can be made of it. While ComReg strives to meet the spectrum demands of all users, inevitably this is not possible because, among other things:

- two or more services/potential users may have competing demands for the same spectrum resource;
- the timing of demand for the same spectrum resource may differ between services/potential users; and/or
- at any one time there may be demand for multiple spectrum bands or multiple spectrum management activities (e.g. the amendment of a licence) by a variety of potential users. Given practical considerations, such as resourcing, it may not be possible to carry out all of these actions at the same time.

ComReg's radio spectrum workload is driven by a wide range of items including:

- **the expiry of existing licences** - where existing spectrum rights of use are due to expire within the near future⁹¹ (e.g. within the next 3 years), ComReg endeavours to set out its proposals on the future use of such bands well in advance of expiry including, where appropriate, defining and carrying-out an assignment process for same;
- **the potential for additional spectrum bands to be released** - given developments such as the harmonisation of a spectrum band⁹² or the potential for re-farming a spectrum band⁹³, it may be appropriate to consider the release of additional spectrum bands; and
- **other developments** - this can relate to a wide range of external developments including national or EU legislation/policy developments⁹⁴, sector-specific or licensee requests⁹⁵ etc.

⁹⁰ A band-by-band consideration of ComReg's spectrum workload is set out in Annex 3 of Consultation 15/131.

⁹¹ For example, the FWALA licences in the 3.6 GHz band expire on 31 July 2017. ComReg's current proposals are set out in Documents 14/101, 15/70 and 15/140.

⁹² For example, in 2015 EU Decision 2015/750 harmonised the 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services.

⁹³ For example, the date for re-farming the 700 MHz band in Europe is currently being considered in relation to the EC's proposal for a decision by the EU Council and Parliament on the 470-790 MHz band [SWD(2016) 19 final], [SWD(2016) 20 final]. <https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-43-EN-F1-1.PDF>

⁹⁴ For example, Decision 243/2012/EU on the multiannual radio spectrum policy programme (RSPP) required member states to carry out the authorisation process for the 800 MHz band by 1 January 2013.

⁹⁵ For example, in 2013 H3GI requested an amendment to its Liberalised Use licence (see Documents 13/43 and 13/70)

6.1.1 APPROPRIATE PRIORITISATION OF SPECTRUM WORK ACTIVITIES

Given the above, ComReg aims to manage its workload in a manner that seeks to appropriately and pragmatically address the needs of a diverse range of actual and potential spectrum users. Relevant considerations in this regard include:

- the capacity within the existing radio spectrum bands to meet spectrum demands. Where capacity exists, it may be possible to meet this demand via the existing spectrum assignments or to award new assignments via existing authorisation processes. In addition, advancements in technologies may lead to a consideration of new band sharing possibilities between different services in existing spectrum bands;
- the timing of the expiry of existing rights of use and the requirement for an appropriate re-assignment process in light of factors such as: end-user demand, harmonisation status, equipment availability, and availability of related (e.g. substitutable and/or complementary) spectrum bands;
- the international harmonisation status of a spectrum band including any future harmonisation plans;
- the harmonisation status and appropriate timing for release of spectrum bands that are currently unassigned;
- the harmonisation status and appropriate timing of radio spectrum bands that could be re-farmed and/or liberalised from one use to another. This can increase the efficient use of spectrum, facilitate innovation and potentially free-up capacity which could be made available for other uses;
- the potential for including multiple spectrum bands in a single award process;

- the adoption of legislation (national or European) which requires ComReg to take specific action/s within a defined timeframe;
- the adoption of national priorities⁹⁶ supported by legislation or similar instruments; and
- the potential for market mechanisms to address spectrum management issues.

The extent to which any of these factors affect ComReg's prioritisation of its workload is considered on a case by case basis. However, recognising that certain activities may provide greater benefits than others, ComReg observes that:

- spectrum bands which are the subject of harmonisation measures⁹⁷ are generally the ones which deliver the most benefits to end-users, given benefits such as increased economies of scale and equipment availability; and
- where appropriate, holding a single award process for multiple spectrum bands can provide greater benefits compared to holding a series of sequential awards for single bands.

The above considerations and ComReg's consideration of the responses received to its draft spectrum work plan as outlined in section 6 of Consultation 15/131 have informed ComReg's spectrum work plan for the period 2016-2018.

Finally, it should be noted that ComReg's spectrum work plan may change over time as the radio spectrum environment is dynamic and new developments will emerge.

⁹⁶ The DCENR is currently in the process of updating its spectrum policy statement. See Consultation on spectrum policy priorities. 7 July 2014. This consultation is to update the DCENR's 2010 statement - DCENR Spectrum Policy Statement, 2010

⁹⁷ ComReg also recognises that in some circumstances the release of non-harmonised spectrum bands can result in an efficient use of spectrum.

6. RADIO SPECTRUM WORK PLAN

FOR 2016 TO 2018

CONT.

6.2 COMREG'S SPECTRUM WORK PLAN 2016 TO 2018

The following outlines the spectrum work plan that ComReg intends to carry out within the time period 2016 to 2018.

6.2.1 COMREG'S SPECTRUM MANAGEMENT FUNCTION

ComReg's spectrum management function includes the licensing of radio spectrum, monitoring its usage, monitoring and enforcing compliance with licence conditions and equipment standards, and promoting Ireland as an ideal location for spectrum development.

In line with its statutory obligations, ComReg will continue to take actions that encourages and ensures the efficient use of spectrum in Ireland including:

- i. granting access to spectrum via licence-exemption or licensing as appropriate;
- ii. authorising spectrum on a non-exclusive basis and encouraging sharing where appropriate and technically feasible;
- iii. increasing transparency on licensees' spectrum assignments and usage via, for example, the publication of non-confidential licence or usage information;
- iv. proactively monitoring compliance and taking enforcement action where appropriate;
- v. investigating cases of radio interference, giving appropriate priority to cases that have safety-of-life implications;
- vi. responding to requests from licensees for changes to licence conditions, including changes to technical conditions that would improve the efficient use of spectrum;
- vii. responding to requests for putting in place new licence regimes or opening new bands for licensing;
- viii. promoting Test and Trial Ireland and the benefits of using Ireland as a location to test or trial wireless products and services in a real world environment; and
- ix. considering emerging spectrum management developments and taking appropriate action (including contributing to defining Ireland's position on such matters and the promotion of same in international fora).

In relation to the last item, ComReg observes that the EC's Digital Single Market proposals and its review of the Common Regulatory Framework are relevant and significant developments that will occur during the timeframe of this strategy. While the outcome, and hence the specific impacts, of these developments are presently unknown, they have the potential to significantly affect ComReg's spectrum work plan over the 2016 to 2018 period.

6.2.2 MOBILE, NOMADIC AND FIXED WIRELESS BROADBAND SERVICES

ComReg has identified the following spectrum work plan items⁹⁸ for mobile, nomadic and fixed wireless broadband services for the period 2016 to 2018:

- i. complete the assignment process for the 3.6 GHz band significantly in advance of the expiry of existing FWALA licences on 31 July 2017;
- ii. actively engage with relevant stakeholders to progress the repurposing of the 700 MHz band so as to obtain clarity on its timing availability;
- iii. further develop ComReg's award proposals in relation to the 700 MHz, 1.4 GHz, 2.3 GHz, and 2.6 GHz bands;
- iv. continue ComReg's consultation process on liberalising the paired 2 GHz band with a view to completing this process within the time period of this spectrum management strategy;
- v. set out a regulatory framework for the leasing of spectrum rights in the RSPP bands in advance of 31 July 2017;
- vi. continue licensing the 10.5 GHz and 26 GHz bands under the existing FWALA licensing regime;
- vii. contribute, develop and promote Ireland's position in relation to the spectrum management aspects of 5G technology;
- viii. consider administrative matters concerning the EC's spectrum divestment commitments in relation to the acquisition of Telefonica by Hutchison at the appropriate time;
- ix. continue to monitor and supervise compliance by MNOs with their respective licence conditions, including via ComReg's drive-testing programme;
- x. continue to publish non-confidential information relating to the results of ComReg's drive-testing programme of mobile networks in Ireland;

⁹⁸ It should be noted that the numbering of specific items does not identify a particular priority ordering from ComReg.

⁹⁹ See section 4.2 in this document.

- xi. facilitate a better understanding of the factors impacting on the actual mobile consumer experience and take appropriate measures on foot of same⁹⁹; and
- xii. commence a consultation process on the future use of the 410-414 / 420-424 MHz band during the lifetime of this strategy management strategy.

In relation to the above, ComReg observes that:

- the envisaged next step in relation to the 3.6 GHz band award is the issue of a response to consultation and final decision in summer 2016;
- it is ComReg's understanding that Ireland's 700 MHz migration activities are indicatively planned for the time period 2019/2020 (i.e. a period of 3-4 years from now);
- noting the considerable work required in relation to the 3.6 GHz band award, it is envisaged that proposals outlining the next steps in the 700 MHz, 1.4 GHz, 2.3 GHz and 2.6 GHz band award process(es) are likely to be provided from the first half of 2017 onwards. ComReg notes that there are various spectrum band options available, including the holding of award process(es) for multiple bands, the holding of award process(es) for a single band, or some combination of these. ComReg will consider each award process on a case by case basis in light of the prevailing circumstances;
- by the middle of 2017 it aims to have issued a further consultation on the liberalisation of the 2 GHz band;
- in relation to the 410-414 / 420-424 MHz band, ComReg continues to observe that there are a number of potential uses for this band that require consideration. For example, while the draft ECC decision on the harmonised technical conditions and frequency bands for the implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems (ECC/DEC/16(02))¹⁰⁰ currently excludes the 410-430 MHz bands, it also states that "studies are currently continuing and where agreed in ECC this could lead to a subsequent revision to this Decision accordingly." ComReg envisages that a consultation on this band would be issued by mid-2017; and
- as discussed in Annex 3 of Consultation 15/131, ComReg is of the view that developments in the 10 to 10.145 GHz band do not warrant any action at this time and, further, observes that no responses were received in relation to this matter.

6.2.3 BROADCASTING SERVICES

ComReg has identified the following spectrum work plan items for broadcasting services for the period 2016 to 2018:

- i. continue to engage in the international coordination of broadcasting transmitter stations to support RTÉ and the BAI to facilitate the development of DTT and analogue and digital sound broadcasting services;
- ii. in collaboration with the BAI and 2rn, finalise an internationally-coordinated spectrum and transition plans for DTT services in the UHF band below 694 MHz;
- iii. commence a review of the licence conditions for some or all broadcasting licences; and
- iv. monitor developments in relation to the broadcasting licences in the UHF, LF, VHF Band II, and VHF band III which are due to expire in 2019, and take actions as appropriate.

In relation to the above, ComReg observes that:

- the spectrum plan for DTT services in the UHF band below 694 MHz is well advanced and the planning group (involving ComReg, BAI and 2rn) aims to finalise the spectrum plan by July 2016 and the transition plan by end 2016; and
- the broadcasting licences for DTT, LW, FM and DAB licences all expire in 2019 and a review of the spectrum management considerations (including licence conditions) significantly in advance of licence expiry is appropriate.

6.2.4 POINT-TO-POINT RADIO LINKS

ComReg has identified the following work plan items concerning point-to-point radio links for the period 2016 to 2018:

- i. consult on the award of national block licences in the 26 GHz band with a view to completing this process significantly in advance of the expiry of existing licences in 2018 and, if appropriate, consider establishing further national block licensing in the 42 GHz band;
- ii. consider adding additional bands to the radio link licensing regime where new ECC Recommendations have been developed (e.g. 55.78 – 57 GHz and 57 – 64 GHz); and
- iii. consider adding a number of bands in the range 5 – 30 MHz for HF fixed links to the radio link licensing list of bands.

¹⁰⁰ [http://www.cept.org/files/1051/Tools%20and%20Services/Public%20Consultations/2016/Draft%20new%20ECCDec\(16\)02.docx](http://www.cept.org/files/1051/Tools%20and%20Services/Public%20Consultations/2016/Draft%20new%20ECCDec(16)02.docx)

6. RADIO SPECTRUM WORK PLAN

FOR 2016 TO 2018

CONT.

In relation to above, ComReg observes that:

- in relation to national block licences in the 26 GHz band, it envisages issuing a consultation by end 2016 and aims to complete the assignment process in 2017; and
- the making available of other spectrum bands for either national block or individual radio link licensing will be considered on a case-by-case basis in line with ComReg's statutory functions, objectives and duties.

6.2.5 SATELLITE

ComReg has identified the following spectrum work plan items concerning satellite networks and services for the period 2016 to 2018:

- i. continue to facilitate the licensing of satellite earth stations (SES) operating in spectrum above 3 GHz and to determine the appropriate means of authorising SES below 3 GHz; and
- ii. consult on establishing a regulatory framework for a Complementary Ground Component (CGC) for the 2GHz Mobile Satellite Service (MSS) with a view to completing this process in 2017.

6.2.6 SHORT RANGE DEVICES (INCLUDING IoT)

ComReg has identified the following spectrum work plan items concerning short range devices (SRDs) for the period 2016 to 2018:

- i. continue to facilitate the use of SRDs in Ireland in line with international harmonisation measures and revise ComReg Document 02/71R in a timely manner following EC and ECC harmonisation updates to facilitate the introduction of new SRDs;
- ii. consider supporting the 76 to 79 GHz radio band for SRDs (to support anti-collision helicopter applications); and
- iii. monitor, contribute to and promote Ireland's spectrum management position in relation to IoT.

6.2.7 AERONAUTICAL, MARITIME, SCIENTIFIC AND DEFENCE

ComReg has identified the following spectrum work plan items concerning the aeronautical, maritime, scientific and defence services for the period 2016 to 2018:

- i. continue to liaise with relevant stakeholders, including the IAA, MRAU, Met Éireann and the Irish Defence Forces, to encourage and ensure the efficient use of spectrum and to promote Ireland's interest at international fora; and
- ii. consult with a view to establishing a licensing regime for a number of miscellaneous services. For example, the licensing of apparatus for gathering metrological information such as RadioSondes.

6.2.8 BUSINESS RADIO SERVICES (INCLUDING PPDR AND PMSE)

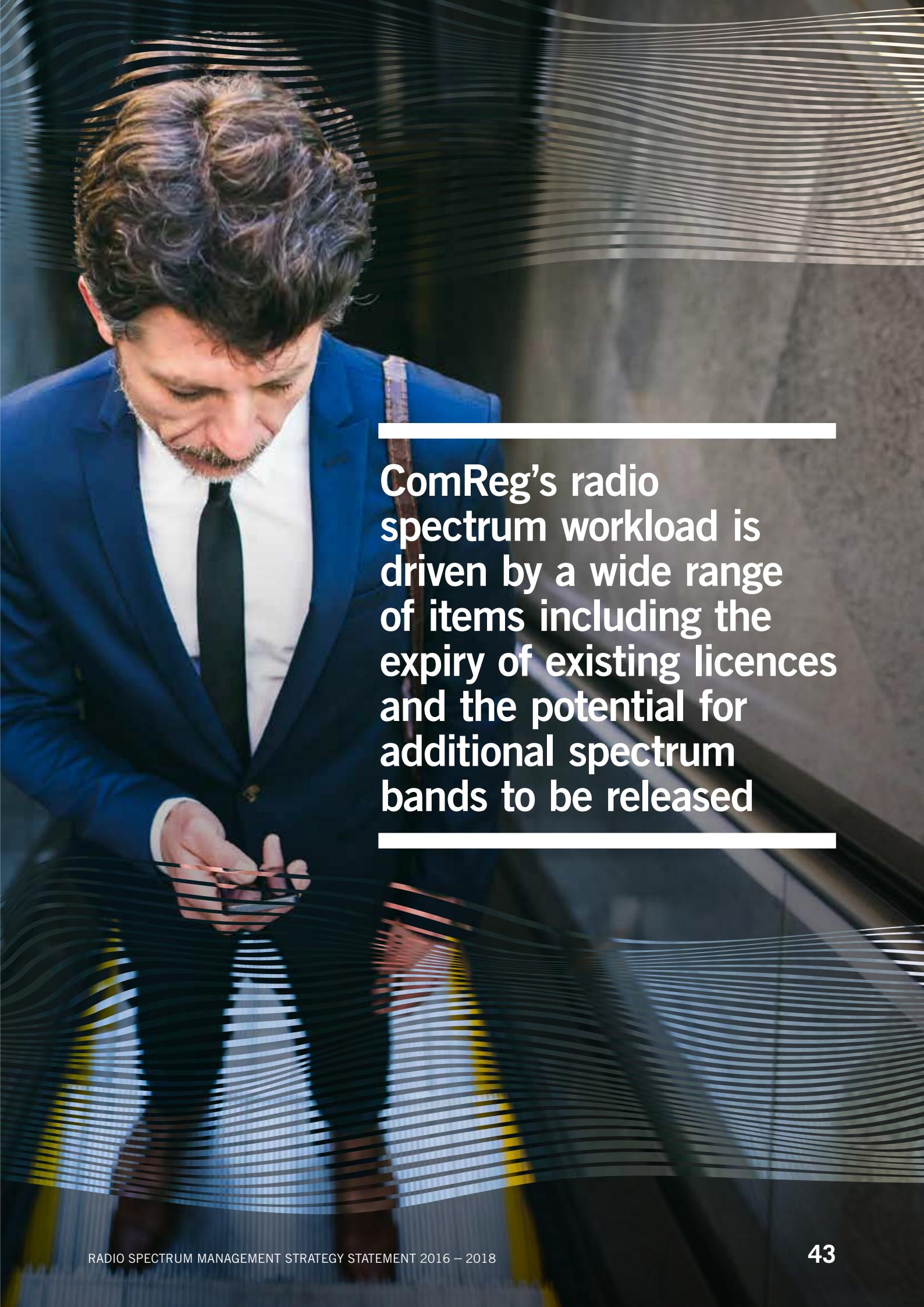
ComReg has identified the following spectrum work plan items for business radio services for the period 2016 to 2018:

- i. consult on a licensing regime for tracing and asset tracking systems;
- ii. consult on a business radio licensing regime to permit the use of national channels on a technology- and service-neutral basis;
- iii. monitor and contribute to the spectrum management considerations of Programme Making and Special Events (PMSE) and take appropriate actions to implement harmonisation decisions; and
- iv. monitor and contribute to the spectrum management considerations in respect of broadband Public Protection and Disaster Relief (PPDR).

6.2.9 RADIO AMATEUR SERVICES

ComReg has identified the following spectrum work plan items for radio amateur services for the period 2016 to 2018:

- i. to make available the 5351.5–5366.5 kHz band in line with the outcome of WRC-15;
- ii. to make available the 30 – 49 MHz and the 54 – 69.9 MHz and 69.9 – 70.125 MHz bands to facilitate propagation beacons, digital amateur television repeaters and to align current allocations with those in the European Common Allocation Table; and
- iii. to make available the 70.45 – 70.50 MHz band to align it with the European Common Allocation Table.



ComReg's radio spectrum workload is driven by a wide range of items including the expiry of existing licences and the potential for additional spectrum bands to be released

7. TOPICAL SPECTRUM MANAGEMENT ISSUES

This chapter outlines ComReg's current thinking on a number of topical spectrum management issues, noting that ComReg's current thinking on the mobile retail consumer experience is set out in chapter 4 above. These issues primarily relate to spectrum rights used for the provision of electronic communications services (ECS), such as fixed, nomadic and mobile wireless broadband services.

In that regard, ComReg observes that:

- › the majority of the items proposed in the spectrum work plan for 2016 to 2018 relate to ECS; and
- › its management of radio frequencies for ECS entails various objectives, powers and duties which are primarily set out in the 2002 Act and the Common Regulatory Framework (and primarily in the Framework and Authorisation Regulations).

The topical spectrum management issues discussed in this chapter include:

- › issues discussed in ComReg's 2011 spectrum management strategy (i.e Documents 11/89 and 11/88) (such as the use of auctions for awarding spectrum rights of use for ECS, the use of spectrum competition caps, spectrum trading, appropriate duration of spectrum rights for ECS, collaboration between wireless operators and spectrum fees); and
- › other spectrum management issues (the sharing of spectrum, coverage/rollout obligations, technology and service neutrality and transparency of information).

This discussion is informed by, among other things:

- › ComReg's consideration of, and general position on, issues that were considered in Documents 11/89 and 11/88;
- › ComReg's approach to these issues in the context of specific relevant completed/ongoing ComReg projects, such as the MBSA (ComReg 12/25 etc.), its proposed award of new rights of use in the 2.6 GHz band and other bands (Document 14/101), and its proposed award of new rights of use in the 3.6 GHz band (Document 15/70, 15/140) etc.;
- › ComReg's consideration of the respondents' views to Consultation 15/131 as set out in Document 16/49; and
- › other relevant developments, including international developments and relevant observations as discussed earlier in Consultation 15/131, Document 16/49 and in this document.

7.1 THE USE OF AUCTIONS FOR AWARDING SPECTRUM RIGHTS OF USE FOR ECS

The following sets out ComReg's current thinking on the use of auctions for awarding spectrum rights of use for ECS. Readers are referred to section 7.1 of Consultation 15/131 and section 4.1 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

In relation to the assignment of spectrum rights for ECS/ECN, ComReg:

- firstly reiterates that it does not favour any specific approach for awarding spectrum rights but prefers to consider each award on its merits;
- notes the clear benefits that auctions offer for the award of spectrum rights of use in bands harmonised for fixed/mobile wireless broadband services (such as identified by it in Documents 11/89 and 11/88);
- observes that both Irish and international spectrum management experience support the continued appropriate use of auctions generally¹⁰¹;
- recognises that there are different auctions formats available and that the most appropriate format for a particular award will, of course, be the one which best addresses the specific facts and circumstances that arise. Nevertheless, a few general observations can be made based on international experience and ComReg's own experience to-date:
 - the CCA format has proven to be an effective auction format, both here and internationally. This format is particularly effective at addressing aggregation risks that may be faced by bidders. For example, when bidders may want a particular suite of spectrum rights across a number of related (i.e. substitutable and/or complementary) bands being award simultaneously, or may want a particular combination of spectrum rights in geographic areas when such rights are being awarded on a sub-national (e.g. local or regional) basis. This format can also significantly mitigate against a number of award risks including gaming and common value uncertainty;

- the SMRA format has been used internationally and could be effective, particularly in circumstances where gaming opportunities are limited, fragmentation risks can be sufficiently addressed and/or aggregation risks are not a material issue; and
- sealed bid combinatorial auctions have been used both here¹⁰² and internationally, and could be an effective auction format, particularly in circumstances where common value uncertainty is likely to be low and competition for spectrum is likely to be weak.

7.2 SPECTRUM TRADING/TRANSFERS

The following sets out ComReg's current thinking on spectrum trading (i.e. transfers or leases). Readers are referred to section 7.2 of Consultation 15/131 and section 4.2 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

Spectrum trading is a spectrum management tool that, along with other measures, can increase the efficient use of spectrum rights.

Observing that the trading of spectrum rights in the harmonised bands, in Ireland and elsewhere in Europe, has primarily occurred in the context of broader corporate control transactions (i.e. mergers or acquisitions such as between MNOs), ComReg would take this opportunity to highlight that:

- spectrum transfers in the RSPP bands in Ireland are required to be notified to ComReg in accordance with the procedures specified in the spectrum transfer framework and regulations¹⁰³;
- the Irish spectrum transfer framework and regulations do not, however, apply to spectrum transfers forming part of a merger or acquisition which is required to be notified to the Competition and Consumer Protection Commission or to the European Commission; and
- the RSPP Decision and the Common Regulatory Framework contemplates leasing of rights of use to radio spectrum.

¹⁰¹ See, for example, the RSPG Report on Efficient Awards and Efficient Use of Spectrum Document RSPG16-004 FINAL, Final, 24 February 2016.

¹⁰² For example, ComReg's award format proposals to assign the three lots of 1800 MHz spectrum that remained unsold in the Multi-band Spectrum Award (MBSA) for Time Slice 1 was a single sealed-bid approach. Document 13/102.

¹⁰³ Document 14/11 and S.I. No. 34 of 2014.

7. TOPICAL SPECTRUM MANAGEMENT ISSUES

CONT.

In relation to spectrum leasing, ComReg's spectrum work plan for the period 2016 to 2018 includes a work item to set out a framework for the leasing of spectrum rights of use in the RSPP bands in Ireland in advance of 31 July 2017.

7.3 APPROPRIATE DURATION FOR SPECTRUM RIGHTS FOR ECS AND TIMING OF ASSIGNMENT PROCESSES

The following sets out ComReg's current thinking on the appropriate duration for spectrum rights for ECS and the timing of assignment processes. Readers are referred to section 7.3 of Consultation 15/131 and section 4.3 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

First, ComReg will continue to establish the appropriate duration of spectrum rights for ECS in accordance with its statutory objectives, powers and duties (including regulation 9(6) of the Authorisation Regulations), and on a case-by-case basis having regard to the particular facts and circumstances of the matter at hand. For example, the specifics of the right of use/spectrum band and award process. In doing so, ComReg will also have regard to relevant international developments, such as the positions taken by other spectrum managers in relevant jurisdictions for the same or similar spectrum bands.

In that regard, ComReg generally observes that the weight of spectrum management practice in Europe and more widely for relevant spectrum bands has been, firstly, for spectrum rights of a finite duration and, secondly, for durations of around 15 to 20 years.¹⁰⁴ ComReg further observe that such durations are broadly similar to those which have been adopted by ComReg (such as in its MBSA process) and are currently proposed by ComReg (for instance in Documents 14/101 and 15/140).

In addition, ComReg considers the claims regarding the uncertainty associated with the periodic re-release of spectrum to be overstated and not to accord with the likely economic incentives of incumbent operators facing such a situation. ComReg also observes that such concerns are likely to be further mitigated in circumstances where:

- rights of use in multiple spectrum bands are used to provide the same consumer services, for example mobile. In this regard, ComReg notes the increased use of carrier aggregation and equipment that operate across multiple spectrum bands and/or technologies; and
- spectrum rights for such bands are issued with different expiry dates, such that at any one time there is a reasonable proportion of spectrum rights not expiring on the same date or an a date relatively closer to each other.

In relation to the provision of mobile consumer services in Ireland, ComReg additionally observes that:

- such services are currently provided with the 800 MHz, 900 MHz, 1800 MHz and 2.1 GHz bands;
- the expiry dates associated with the spectrum rights in the above bands varies from 2022/2027 for the 2.1 GHz band to 2030 for the 800 MHz, 900 MHz and 1800 MHz bands; and
- going forward, these services may also be provided using spectrum rights in other harmonised bands such as the 700 MHz, 1.4 GHz, 2.3 GHz, 2.6 GHz and/or 3.6 GHz bands, noting that the expiry dates of new spectrum rights for these bands have yet to be determined.

In circumstances where existing spectrum rights of use are not liberalised and where timely and efficient infrastructure investments, ecosystem permitting, could allow licensees to deploy new services sooner, ComReg observes that, among other things, measures such as the holding of an award process for liberalised spectrum rights sufficiently in advance of the expiry of existing spectrum rights, and including an appropriately fashioned 'early liberalisation' option (such as that utilised in the MBSA process), could be a useful mechanism to address such circumstances. When ComReg consults on its spectrum management strategy statements, ComReg generally notes the rights of use that are due to expire within the following 5-6 years and includes this in its proposed spectrum work plan for the bands where it proposes to start to consult on an award process during the next two years. Holders of spectrum rights who consider that the award process for any particular band should be brought forward therefore have the opportunity to highlight this (preferably with supporting reasons and evidence) when responding to the consultation.

¹⁰⁴ See, for example, the RSPG Report on Efficient Awards and Efficient Use of Spectrum Document RSPG16-004 FINAL, Final, 24 February 2016.

7.4 THE SHARING OF SPECTRUM AND COLLABORATION BETWEEN WIRELESS OPERATORS

This section sets out ComReg's current thinking on:

- › the sharing of spectrum between different services or users. For example, the use of SRDs in the same band as licensed users; and
- › collaboration between wireless operators in the provision of wireless/mobile services. Such collaboration can take many forms, including the sharing of network infrastructure and/or the sharing of spectrum between two or more wireless operators.

7.4.1 THE SHARING OF SPECTRUM

Readers are referred to section 7.4.1 of Consultation 15/131 and section 4.4 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

ComReg's current thinking on spectrum sharing is that:

- › it would continue to facilitate the sharing of spectrum between different usages/users in a manner that improves the efficient use of spectrum, subject to the normal spectrum management and competition considerations; and
- › it will continue its practice of issuing all authorisations (licence exemptions and licences) on a non-exclusive basis (including, of course, where such an approach in respect of specific spectrum bands is required by law).

7.4.2 COLLABORATION BETWEEN WIRELESS OPERATORS

Readers are referred to section 7.4.2 of Consultation 15/131 and section 4.4 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

Recalling that there are many forms of collaboration and, further, that the benefits and drawbacks of each collaboration will depend on the specifics of the proposed collaboration, ComReg maintains that it cannot have a firm view on spectrum rights sharing (or pooling) and network sharing other than that it would look more favourably on agreements that would not unduly restrict competition and would deliver demonstrable benefits that are shared with end-users.

Further, ComReg remains of the view that interested parties should be in a position to identify for themselves the types of potential issues and concerns (e.g. competition law) that could be raised by a proposed collaboration agreement.

7.5 COMPETITION CAPS ON SPECTRUM

The following sets out ComReg's current thinking on the use of competition caps for spectrum. Readers are referred to section 7.5 of Consultation 15/131 and section 4.5 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

In competitions for spectrum rights (and, in particular, auctions), ComReg considers that spectrum competition caps are an important tool by which to safeguard and promote competition – both for spectrum rights and downstream competition. ComReg would also add that:

- › the main purpose of a competition cap is to ensure that the distribution of spectrum is determined by competition amongst the bidders, subject to ensuring that extreme asymmetric outcomes, which could harm downstream competition, do not emerge from the proposed award;
- › it will consider appropriate measures to promote competition (e.g. new entry) where objectively justified and proportionate;
- › it is ComReg's practice to consider, among other matters, other relevant (e.g. substitutable and/or complementary) existing spectrum holdings when determining the level of a competition spectrum cap (if any) prior to a given award; and
- › following the completion of a spectrum award, a spectrum competition cap does not constrain an operator from acquiring additional spectrum rights from other operators on a transfer/lease or sale basis, subject to the normal controls on competition and spectrum management.

7. TOPICAL SPECTRUM MANAGEMENT ISSUES

CONT.

7.6 SPECTRUM FEES

The following sets out ComReg's current thinking on the spectrum fees. Readers are referred to section 7.6 of Consultation 15/131 and section 4.6 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

Overall, it is ComReg's current thinking that:

- › spectrum fees for rights for ECS are an important tool by which ComReg can ensure the efficient use of such rights;
- › the level of the spectrum fee (and any minimum price) will continue to be determined on a case by case basis in light of the relevant circumstances of the spectrum award (such as the particulars of the rights of use/spectrum band, international benchmarks etc);
- › the timing and manner in which spectrum fees are to be paid will continue to be determined on a case by case basis, noting that such fees can be apportioned between an upfront spectrum access fee and ongoing spectrum usage fees (SUFs); and
- › SUFs should be updated on a regular basis (preferably annually) using the Consumer Price Index (CPI) with a view to ensuring that the value of these usage fees remains constant in real terms.

7.7 COVERAGE/ROLLOUT CONDITIONS

The following sets out ComReg's current thinking on the coverage/rollout conditions. Readers are referred to section 7.7 of Consultation 15/131 and section 4.7 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

ComReg current thinking on coverage and/or rollout is that:

- › coverage and/or rollout obligations are an important tool to ensure the efficient use of radio spectrum, and to promote the interests of users generally;

- › given the broad range of potentially relevant factors¹⁰⁵ involved and often a complex relationship between same, it is necessary to determine the appropriate nature and extent of coverage and/or rollout conditions on a case by case basis in light of the particular facts and circumstances arising; and
- › it remains mindful of the potential for competition to drive coverage to high levels.

7.8 TECHNOLOGY AND SERVICE NEUTRALITY

The following sets out ComReg's current thinking on technology- and service-neutrality. Readers are referred to section 7.9 of Consultation 15/131 and section 4.9 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

ComReg's current thinking on technology and service neutrality is that:

- › where appropriate, ComReg favours and promotes the application of technology- and service-neutrality in line with the relevant harmonisation measures; and
- › in applying such harmonisation decisions to a frequency band where there are existing rights of use, ComReg remains conscious that there are potential impacts to be considered on a case by case basis, including:
 - › the benefits to consumers in terms of furthering their interests by, for example, encouraging innovation, investment, and the availability and use of liberalised services in Ireland which can result in better choice, price, quality of service and value for money; and
 - › whether liberalisation may give rise to a material risk of a distortion of competition to the detriment of consumers such that any benefits resulting from liberalisation would be outweighed by the detriment to consumers resulting from any such a distortion of competition.

¹⁰⁵ For example, compared to low data rate or voice services the reception of higher data services and applications is more susceptible to swifter degradation in areas where the signal is weak. This could be relevant to considerations related to the nature and extent of consumer expectations.



While usage and devices have changed rapidly in the past few years so also have consumer expectations evolved significantly

7. TOPICAL SPECTRUM MANAGEMENT ISSUES

CONT.

7.9 TRANSPARENCY OF RADIO SPECTRUM INFORMATION

The following sets out ComReg's current thinking on transparency of radio spectrum information. Readers are referred to the section 7.10 of Consultation 15/131 and section 4.10 of Document 16/49 for ComReg's detailed considerations on this matter.

COMREG'S CURRENT THINKING

Subject to the protection of confidential information in line with ComReg's guidelines (as set out in Document 05/24), ComReg sees merit in publishing more information on existing licensees' spectrum assignments and usage because, among other things, this can increase the efficient use of spectrum by better informing consumers and other interested parties (such as actual and potential spectrum users).





ANNEX 1: SUMMARY OF LEGAL FRAMEWORK AND STATUTORY OBJECTIVES RELEVANT TO MANAGEMENT OF RADIO SPECTRUM

The Communications Regulation Acts 2002 as amended¹⁰⁶ (the “2002 Act”), the Common Regulatory Framework (including the Framework and Authorisation Directives¹⁰⁷ as transposed into Irish law by the corresponding Framework and Authorisation Regulations¹⁰⁸), and the Wireless Telegraphy Acts 1926 to 2009¹⁰⁹ 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.

Apart from licensing and making regulations in relation to licences, ComReg’s functions include the management of Ireland’s radio frequency spectrum in accordance with ministerial Policy Directions under Section 13 of the 2002 Act, having regard to its objectives under Section 12 of the 2002 Act, Regulation 16 of the Framework Regulations and the provisions of Article 8a of the Framework Directive. ComReg is to carry out its functions effectively, and in a manner serving to ensure that the allocation and assignment of radio frequencies is based on objective, transparent, non-discriminatory and proportionate criteria.

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.

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

A1.1 PRIMARY OBJECTIVES AND REGULATORY PRINCIPLES UNDER THE 2002 ACT AND COMMON REGULATORY FRAMEWORK

ComReg’s primary objectives in carrying out its statutory functions in the context of electronic communications are to:

- promote competition¹¹⁰;
- contribute to the development of the internal market¹¹¹;
- promote the interests of users within the Community¹¹²;
- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under Section 13 of the 2002 Act¹¹³; and

¹⁰⁶ The Communications Regulation Act 2002 (as amended), the Communications Regulation (Amendment) Act 2007, the Communications Regulation (Premium Rate Services and Electronic Communications Infrastructure) Act 2010 and the Communications Regulation (Postal Services) Act 2011.

¹⁰⁷ 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”)

¹⁰⁸ 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.

¹⁰⁹ The Wireless Telegraphy Acts 1926 to 1988 and Sections 181 (1) to (7) and (9) and Section 182 of the Broadcasting Act 2009.

¹¹⁰ Section 12 (1)(a)(i) of the 2002 Act.

¹¹¹ Section 12 (1)(a)(ii) of the 2002 Act.

¹¹² Section 12(1)(a)(iii) of the 2002 Act.

¹¹³ 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.

- › 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 Regulations¹¹⁴ in particular those designed to ensure effective competition¹¹⁵.

A1.1.1 PROMOTION OF COMPETITION

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.

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.

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.

A1.1.2 CONTRIBUTING TO THE DEVELOPMENT OF THE INTERNAL MARKET

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.

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.

A1.1.3 PROMOTION OF INTERESTS OF USERS

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;

¹¹⁴ 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).

¹¹⁵ Regulation 16(1)(a) of the Framework Regulations.

ANNEX 1: SUMMARY OF LEGAL FRAMEWORK AND STATUTORY OBJECTIVES RELEVANT TO MANAGEMENT OF RADIO SPECTRUM

CONT.

- 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.

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.

A1.1.4 REGULATORY PRINCIPLES

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, nondiscriminatory 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.

A1.1.5 BEREC

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.

A1.1.6 OTHER OBLIGATIONS UNDER THE 2002 ACT

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;¹¹⁶
- have regard to international developments with regard to electronic communications networks and electronic communications services, associated facilities, postal services, the radio frequency spectrum and numbering¹¹⁷; and

¹¹⁶ Section 12(3) of the 2002 Act.

¹¹⁷ Section 12(5) of the 2002 Act.

- › 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.¹¹⁸

A1.1.7 POLICY DIRECTIONS¹¹⁹

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.

The Policy Directions which are most relevant in this regard include the following:

POLICY DIRECTION NO.3 ON BROADBAND ELECTRONIC COMMUNICATION NETWORKS

ComReg shall in the exercise of its functions, take into account the national objective regarding broadband rollout, viz, the Government wishes to ensure the widespread availability of open-access, affordable, always-on broadband infrastructure and services for businesses and citizens on a balanced regional basis within three years, on the basis of utilisation of a range of existing and emerging technologies and broadband speeds appropriate to specific categories of service and customers.

ComReg is conscious that the three year objective described in this policy direction has now expired making this direction less relevant currently.

POLICY DIRECTION NO.4 ON INDUSTRY SUSTAINABILITY

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 ONLY WHERE NECESSARY

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

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

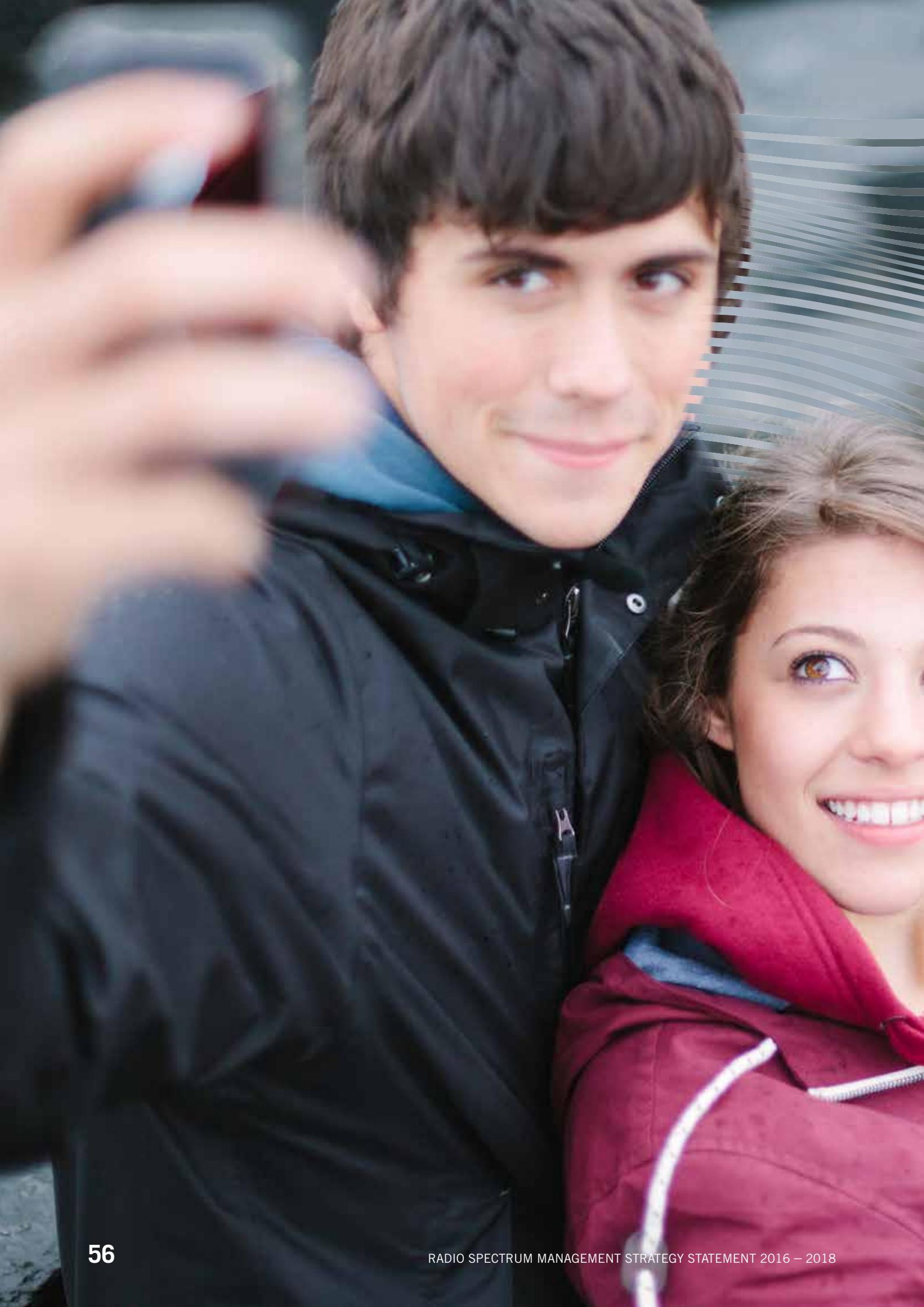
ComReg shall ensure that, where market circumstances are equivalent, the regulatory obligations imposed on undertakings in the electronic communications market in Ireland should be equivalent to those imposed on undertakings in equivalent positions in other Member States of the European Community.

POLICY DIRECTION NO.11 ON THE MANAGEMENT OF THE RADIO FREQUENCY SPECTRUM

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.

¹¹⁸ Section 12(6) of the 2002 Act .

¹¹⁹ ComReg also notes, and takes due account of, the Spectrum Policy Statement issued by the Department of Communications Energy and Natural Resources in September 2010.





A significant element of ComReg's strategy is to prioritise the release of spectrum capable of supporting wireless broadband use both in a fixed and mobile context

ANNEX 1: SUMMARY OF LEGAL FRAMEWORK AND STATUTORY OBJECTIVES RELEVANT TO MANAGEMENT OF RADIO SPECTRUM

CONT.

GENERAL POLICY DIRECTION NO.1 ON COMPETITION (2004)

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.

A1.2 OTHER RELEVANT OBLIGATIONS UNDER THE FRAMEWORK AND AUTHORISATION REGULATIONS

A1.2.1 FRAMEWORK REGULATIONS

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.

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.

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).

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.

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”).

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.

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.

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.

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.

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.

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.

A1.2.2 AUTHORISATION REGULATIONS

DECISION TO LIMIT RIGHTS OF USE FOR RADIO FREQUENCIES

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.

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.

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 leaseable between undertakings in accordance with Regulation 19 of the Framework Regulations.

ANNEX 1: SUMMARY OF LEGAL FRAMEWORK AND STATUTORY OBJECTIVES RELEVANT TO MANAGEMENT OF RADIO SPECTRUM

CONT.

PUBLICATION OF PROCEDURES

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

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

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.

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.

Regulation 10(2) also requires that any attachment of conditions under Regulation 10(1) to rights of use for radio frequencies must be non-discriminatory, proportionate and transparent and in accordance with Regulation 17 of the Framework Regulations.

PROCEDURES FOR LIMITING THE NUMBER OF RIGHTS OF USE TO BE GRANTED FOR RADIO FREQUENCIES

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.

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.”*

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

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.

ComReg is required to ensure that any such fees are objectively justified, transparent, non-discriminatory and proportionate in relation to their intended purpose and take into account the objectives of ComReg as set out in Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations.

AMENDMENT OF RIGHTS AND OBLIGATIONS

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).

A1.3 OTHER RELEVANT PROVISIONS

WIRELESS TELEGRAPHY ACT, 1926 AS AMENDED (THE “1926 ACT”)

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.

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.

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.

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.

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.

BROADCASTING ACT 2009 (THE “2009 ACT”)

Section 132 of the 2009 Act relates to the duties of ComReg in respect of the licensing of spectrum for use in establishing digital terrestrial television multiplexes and places an obligation on ComReg to issue:

- two DTT multiplex licences to RTÉ by request (see Sections 132 (1) and (2) of the 2009 Act); and
- a minimum of four DTT multiplex licences to the BAI by request (see Sections 132 (3) and (4) of the 2009 Act) for the provision of commercial TV content.

ARTICLE 4 OF DIRECTIVE 2002/77/EC (COMPETITION DIRECTIVE)

Article 4 of the Competition Directive provides that:

"Without prejudice to specific criteria and procedures adopted by Member States to grant rights of use of radio frequencies to providers of radio or television broadcast content services with a view to pursuing general interest objectives in conformity with Community law:

- Member States shall not grant exclusive or special rights of use of radio frequencies for the provision of electronic communications services.
- The assignment of radio frequencies for electronic communication services shall be based on objective, transparent, non-discriminatory and proportionate criteria."

RADIO SPECTRUM POLICY PROGRAMME

On 15 February 2012, the European Parliament adopted the five-year Radio Spectrum Policy Programme which establishes a multi-annual radio spectrum policy programme for the strategic planning and harmonisation of the use of spectrum. The objective is to ensure the functioning of the internal market in the Union policy areas involving the use of spectrum, such as electronic communications, research, technological development and space, transport, energy and audiovisual policies.

Among the activities being undertaken in the context of the RSPP is a comprehensive inventory of spectrum use in the range 400 MHz to 6 GHz in order to identify developing and potentially significant uses of that spectrum.



A large ship, possibly a container ship, is shown from a low angle, moving from left to right across the frame. It creates a significant white wake behind it. The water is dark and textured. In the background, a distant shoreline with hills and buildings is visible under a clear sky.

**A conservative estimate
of the number of
employees in Ireland
whose jobs are
dependent on the use
of radio spectrum was
nearly 29,000 for 2014**

ANNEX 2: METHODOLOGY

FOR CALCULATING THE

CONTRIBUTION OF RADIO

SPECTRUM

The methodology used to calculate the contribution of radio spectrum to the Gross Domestic Product of Ireland as presented in this document is based on the value added¹²⁰ measure of an economic entity's contribution to the GDP, and authoritative data obtained from corporate financial statements listed with the Irish Companies Registration Office and data from the Central Statistics Office has been used as input to this calculation.

Radio spectrum is considered fundamental to the provision of many services. For example, mobile communications can only be undertaken via the use of radio frequencies. This is also true for most broadcasting services provided in Ireland. Additionally, radio spectrum can also be considered 'fundamental' to the aviation sector, since the safe operation and volume of air traffic could only be accomplished through the use of radio. Other sectors, such as the medical device industry, make use of radio though only in a tangential way. In total, 8 sectors have been identified for analysis: broadcasting, mobile, aviation, fixed wireless, mobile support, mobile retail, radio technology, and low power devices. The value added measure of each of these sectors is estimated and then aggregated to estimate the total contribution to GDP in Ireland.

This calculation uses the income approach to calculate the contribution of GDP.¹²¹ The income approach adds components of value added to derive GDP. A measure of GDP using the income approach is expressed in the following way:

$$\text{GDP} = \text{Gross Operating Surplus} + \text{Compensation of Employees} + \text{mixed income} + \text{taxes on production less subsidies}^{122}$$

In a GDP calculation, the Gross Operating Surplus is a measure of company profitability. It should be noted however, that this is not the same as gross profit or operating profit as set out in a company's national accounts. As such a firm's operating profit as outlined in the company accounts requires a number of adjustments in order to align it with the National Accounts measure of Gross Operating Surplus. This involves making an adjustment to account for net interest paid and depreciation and/or amortisation listed by each company. Additionally, modest multiplier effects are estimated across the entire economy.¹²³

The estimate of GDP contribution is qualified in two important respects. First, the estimate excludes small companies to which the Companies (Amendment) Act 1986 applies¹²⁴ because such companies are exempt from filing a full set of financial accounts. As a result, some data needed to perform the GDP contribution estimate cannot be readily obtained in accordance with the above methodology. While the individual turnover amounts for small companies are relatively low, on aggregate the contribution of small wireless companies and private unlimited companies may actually be quite large but otherwise unaccounted for.

The second qualification relates to the types of companies making use of radio. Since users (and uses) of radio spectrum are not homogenous, spectrum usage was categorized as either fundamental or tangential to various different types of corporate operations. This excludes a number of profitable companies employing substantial numbers that for instance develop complex software for the operations and billing aspects of networks.

These two qualifications result in a conservative estimate.

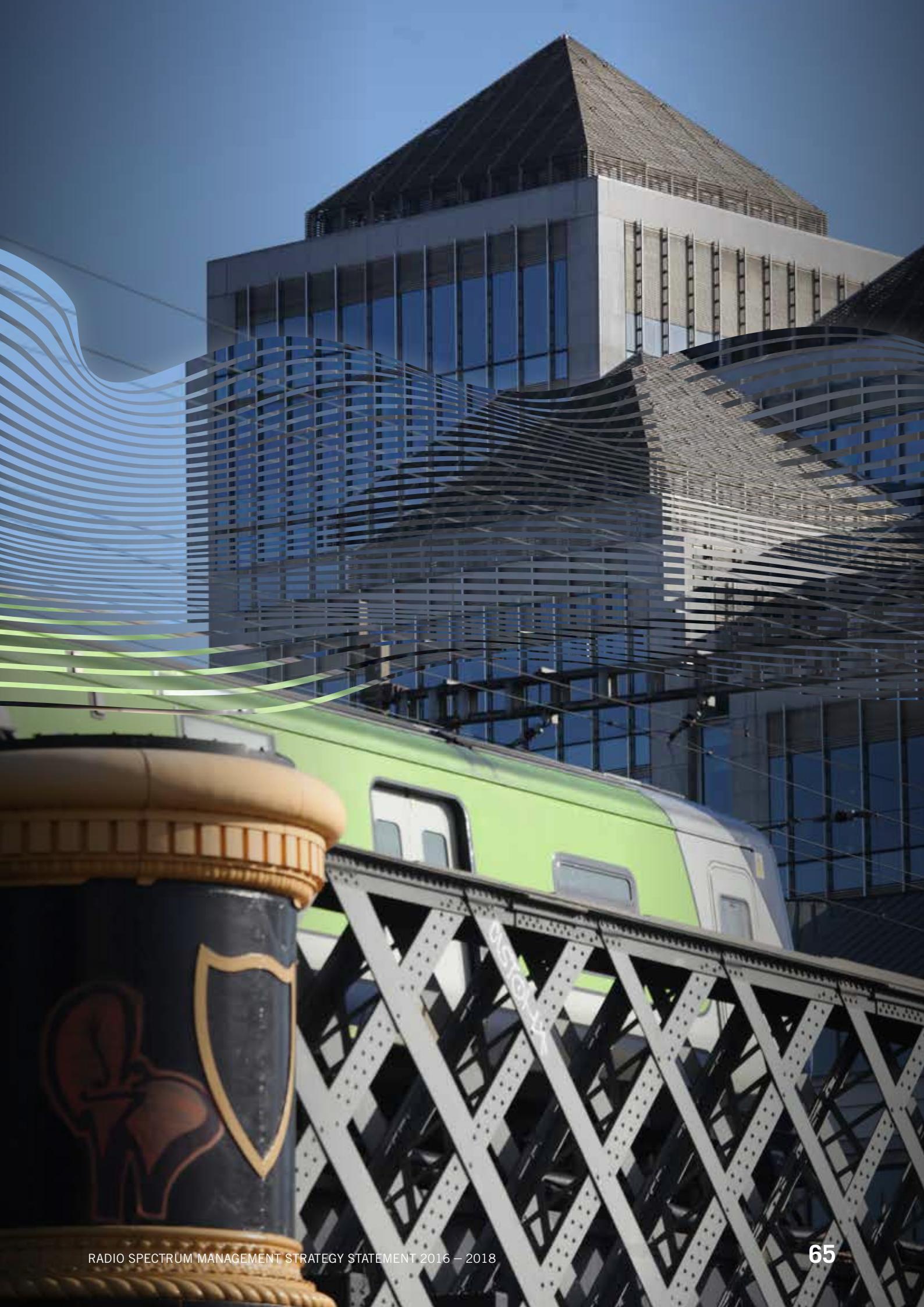
¹²⁰Value added represents the contribution of labour and capital to production. The value added of a given company making use of radio spectrum was determined by taking the profits generated by its operations and adding it to company compensation to employees, namely its wages, salaries and social insurance contributions. Payments to staff provide an indirect contribution to the economy as a result of wages spent.

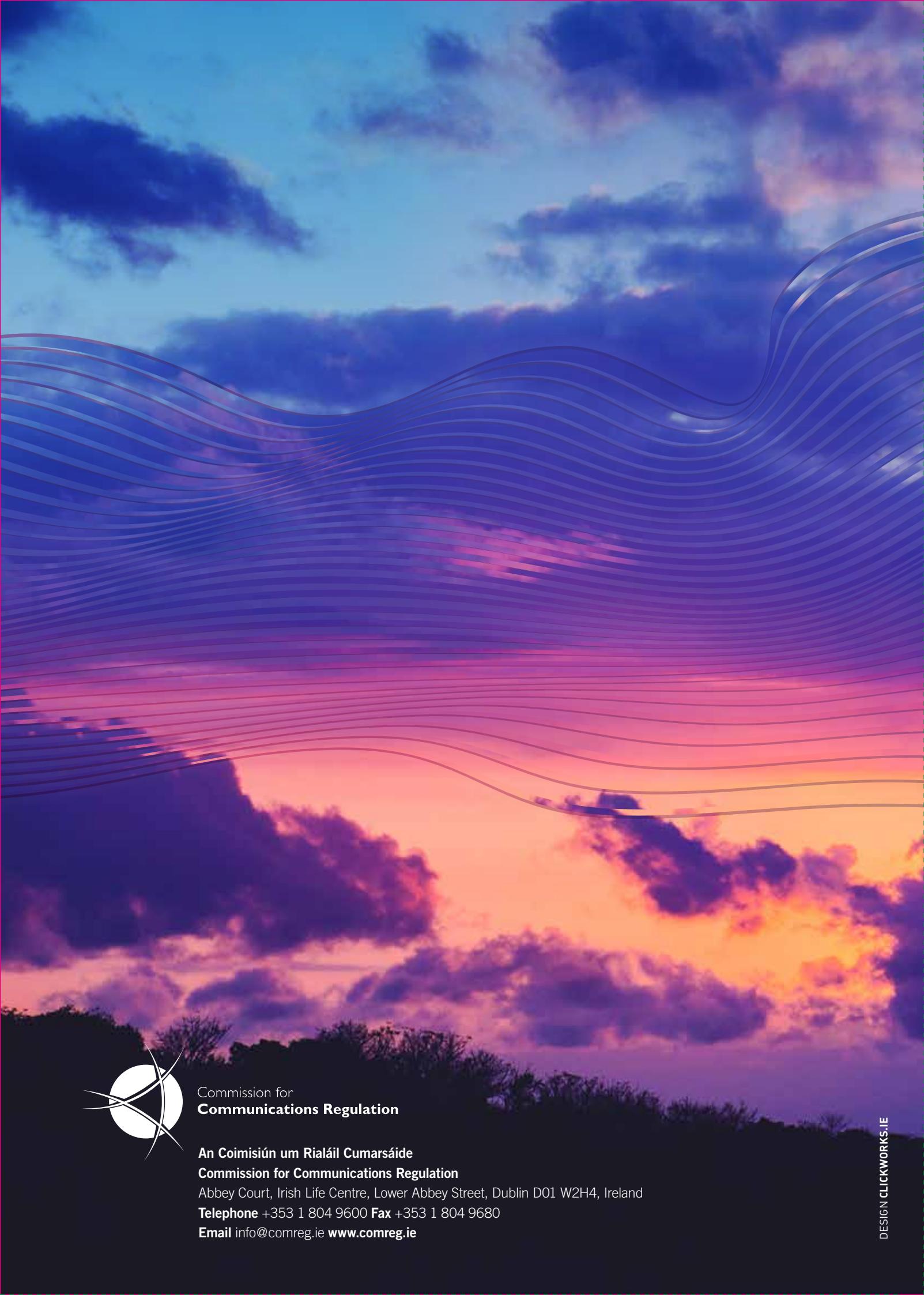
¹²¹This approach is slightly different to the approach used in the previous spectrum management strategy documents. It is therefore not appropriate to directly compare the results in this document against the results presented in previous spectrum management strategy documents.

¹²²Mixed income is not considered in this analysis since it refers to remuneration for the work carried out by the owner (or by members of his/her family) of an unincorporated enterprise, taxes on production is considered using CSO data.

¹²³In economic theory, multipliers are premised on the notion that an initial spending rise can lead to even greater increase in national income as a result of indirect effects associated with the expenditure. In other words, an initial change in aggregate demand can cause a further change in aggregate output for the economy. In order to be consistent with previous statements, the general economic multiplier used in this statement is that reported in "The Macro-economy of Ireland," by Leddin and Walsh.

¹²⁴ss. 11, 12 Companies (Amendment) Act 1986. 'Small companies' have a turnover of less than €3.81m and fewer than 50 employees.





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