Commission for
Communications Regulation

# Draft Radio Spectrum Management Strategy 2016 to 2018

## Consultation on ComReg's radio spectrum management strategy

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Chapter 1

# 1 Executive Summary

1.1 Radio spectrum is a valuable national resource underpinning important economic, social and communications activities. These include widely used services, such as mobile/fixed wireless communications and broadband, 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.

1.2 In Ireland, the Commission for Communications Regulation (ComReg) is the statutory body responsible for the management of radio spectrum, and this documents sets out ComReg's draft radio spectrum management strategy for the period 2016 to 2018.

1.3 In setting out its strategy, ComReg has considered the economic contribution of radio spectrum to Irish Gross Domestic Product (GDP). ComReg's analysis conservatively suggests that the direct contribution of radio spectrum continues to increase, and based on the most recent data available (2013) this contribution was over €4.2 billion, or approximately 2.4% of GDP, with circa 28,000 people employed through the use of radio spectrum.

1.4 In order to inform this consultation process, ComReg reflects on a number of significant developments that have occurred in recent times, including:

- the switchover from analogue to digital terrestrial television (DTT) services completed in October 2012. This process resulted in a "digital dividend" for both the broadcasting and mobile sectors in the form of increased ability to provide programing content on DTT and the successful release of the 800 MHz band;
- successful assignment of an additional 150 MHz of spectrum rights of use for mobile wireless broadband services in three important spectrum bands (namely the 800 MHz, 900 MHz and 1800 MHz bands). This occurred in late 2012 with the completion of ComReg's Multi-Band Spectrum Award (MBSA) process and following switchover to DTT from analogue;
- subsequent rollout of new 3G and 4G services in the 800 MHz, 900 MHz and 1800 MHz spectrum bands, and the increased user demand for mobile data services driven by the near ubiquitous availability of smartphones. Between Q2 2011 and Q2 2015, data usage on the Irish

mobile networks increased by almost 500%, and forecasts predict significant increases continuing for many years to come[1];

- the acquisition of Telefónica Ireland Limited (Telefonica) by Hutchison 3G UK Holdings Limited (Hutchison) which was notified to the European Commission (EC) in 2013 and conditionally approved by the EC in 2014. 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;
- preparations to progress any future repurposing of the 700 MHz band in line with the resolution adopted at the World Radio Conference (WRC) of 2012 which allocates this band to mobile service (excluding aeronautical) on a co-primary status with broadcasting. For example, ComReg:
    - is working on a revised UHF band plan to migrate DTT services below the 700 MHz band with envisaged completion date in Q2 2016; and
    - has set out the results of a cost benefit analysis (CBA) of a change of use of the 700 MHz band to mobile which estimated a positive NPV (net present value) of over €91m, which assisted ComReg to form the view that Ireland can and should repurpose the 700 MHz band in line with international harmonisation measures and radio spectrum releases elsewhere.
- 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.

1.5 The potential radio spectrum demand of specific radiocommunication service categories[2] is then considered, noting that 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.

[1] 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).

[2] 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.

## Draft spectrum management work plan for 2016 to 2018

1.6 The draft spectrum management work plan for 2016 to 2018 is next outlined, in light of the matters discussed throughout this document, the envisaged radio spectrum workload[3] and the need for appropriate prioritisation of spectrum activities, as inevitably it is not feasible to meet the demands of all spectrum users.

1.7 In that regard, 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[4] 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.

1.8 The draft spectrum work plan for 2016 to 2018 outlines the indicative work plan items that ComReg intends to carry out within that timeframe in terms of its spectrum management function (e.g. granting access to spectrum via licence-exemption or licensing as appropriate) and the specific radiocommunication service categories.

1.9 A number of indicative work plan items are outlined, including:

- 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 find an internationally coordinated spectrum plan for DTT services in the UHF band below 694 MHz; and

[3] The envisaged spectrum workload is driven by a number of factors including: the expiry of existing licences, the potential for additional spectrum bands to be released, and other developments.

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

- 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.

1.10 ComReg observes that these proposed work plan items align with its key priorities for radio spectrum as set out in its strategy statement on Electronic Communications (Document 14/75), specifically:

- finalise a strategy for the UHF band (470 to 790 MHz);
- release additional spectrum for wireless broadband; and
- Test & Trial Ireland - promote Ireland's research and development agenda.

1.11 Further ComReg's proposed work plan accords with 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.

1.12 This draft strategy statement 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 consumer experience, technology and service neutrality and transparency of information.

### Next steps

1.13 This consultation will be open for a period of five weeks until 16:00 on 18 January 2016. Views and comments are welcome on any matters raised in this document. Where practicable, submissions should be referenced to the relevant section(s) (or, to particular paragraph number(s) in each chapter and annex in this document.

1.14 Following receipt and consideration of submissions received, and other relevant material, ComReg intends to then finalise its strategy for managing the use of radio spectrum in Ireland for the period 2016 – 2018 and publish same alongside a response to consultation document.

Chapter 2

# 2 Introduction

## 2.1 Background and Purpose

2.1 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.

2.2 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 mobile communications, 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.

2.3 To assist ComReg's management of the radio spectrum, ComReg regularly sets out and updates its strategy for managing the radio spectrum.[5] ComReg's current spectrum management strategy statement (ComReg Document 11/89[6]) was finalised in 2011 and that document set out ComReg's position on a number of spectrum management issues and its work plan priorities at that time.

2.4 This document sets out ComReg's proposals to update its spectrum management strategy and work plan proposals for the period 2016 to 2018.

## 2.2 Structure of this document

2.5 This document is structured as follows:

- **Chapter 3** provides an introduction to Ireland's radio spectrum and the importance of managing the radio spectrum in Ireland;

[5] This is in line with ComReg's obligations under section 31 of the Communications Regulation Act 2002 to 2011 (as amended).

[6] See ComReg Document 11/89, "Strategy for Managing the Radio Spectrum: 2011 – 2013"

- **Chapter 4** considers 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 draft radio spectrum work plan for the period 2016 to 2018;
- **Chapter 7**: sets out ComReg's current thinking on several topical spectrum management issues; and
- **Chapter 8**: sets out details of the next steps including the requirements for making submissions.

**ANNEXES supporting this document:**

- **Annex 1**: Summary of ComReg's statutory framework relevant to the management of the radio frequency spectrum in Ireland;
- **Annex 2**: Methodology used in calculating the economic contribution of radio spectrum to Ireland;
- **Annex 3**: Detailed considerations on ComReg's spectrum workload; and
- **Annex 4**: Vodafone letter to ComReg and correspondence.

Chapter 3

# 3 Spectrum management in Ireland

3.1 Radio spectrum is the medium over which all wireless communications (microphones, mobile phones, radars, radios, televisions, connected devices etc.) take place.

## 3.1 The importance of radio spectrum

3.2 Analysis carried out by ComReg[7], based on company financial records and data from the national accounts, suggests that the economic contribution to Irish Gross Domestic Product (GDP) arising from the use of radio spectrum in 2013 was over €4.2 billion, or approximately 2.4% of GDP[8].

3.3 Figure 1 below illustrates the relationship between Ireland's GDP in years 2009 to 2013 with the aggregate economic contribution from the use of radio spectrum over the same period. This graph highlights that the direct contribution of radio spectrum increased from €3.9bn in 2009 to €4.2bn in 2013, when modest multiplier effects are taken into account.

[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.

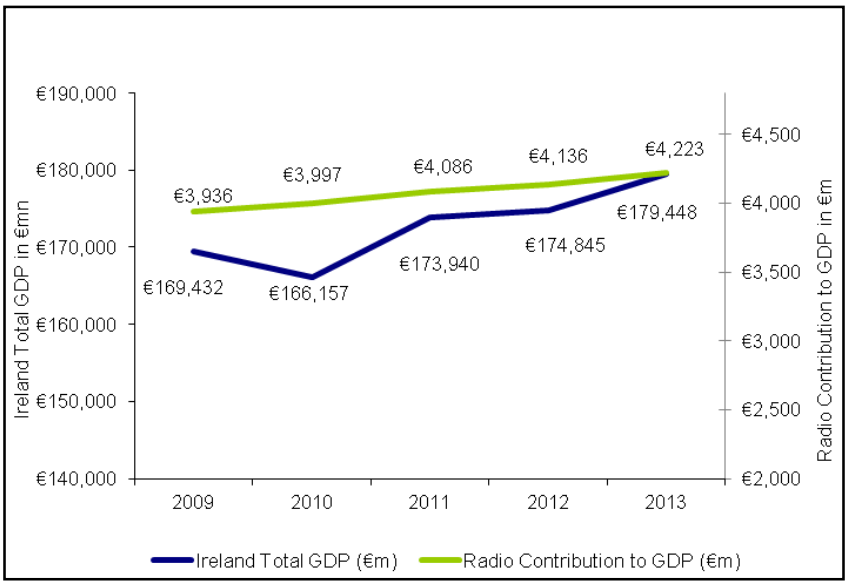


**Figure 1: Contribution of Radio Spectrum to GDP: 2009 – 2013**

3.4 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 28,000 in 2013[9].

3.5 There are also considerable social benefits[10] 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 spectrum plays 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.

3.6 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]

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

[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 State of Broadband 2015, Universalising Broadband and ITU, Technology Broadband and Education: Advancing Education for all Agenda 2013, and

## 3.2 Spectrum Policy and Management in Ireland

### 3.2.1 Spectrum Policy

3.7 A key role of the Department of Communications, Energy and National Resources (DCENR) is the development of policies for the regulation and optimum 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 to develop a national broadcasting policy and associated spectrum use.

3.8 The DCENR is in the process of updating[12] its spectrum policy statement which it published in 2010[13].

### 3.2.2 Spectrum Management: ComReg's mandate and role

3.9 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 Directives[14] as transposed into Irish law by the corresponding Framework and Authorisation Regulations[15]), 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[17].

- The impact of broadband on the economy, 2011 (broadbandabandcommission.org/reports).

See also Lars-Hendrik Roller, 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.

[17] Annex 1 sets out ComReg's legal framework and statutory objectives in relation to radio spectrum.

3.10 In exercising its function of the management of Ireland's radio frequency spectrum (and in accordance with relevant ministerial Policy Directions 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.

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

3.12 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:

- 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.

3.13 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 public policy.

## 3.3 Overview of ComReg's spectrum management activities

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

- licensing of radio spectrum in Ireland 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.

## 3.3.1 Spectrum management processes

### 3.3.1.1 International aspects to spectrum management

3.15 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.

3.16 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), while 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.

3.17 As the radio spectrum manager, ComReg is charged with the implementation of international treaties and obligations[18] relating to the use of radio spectrum in the

[18] The interference-free operation of radiocommunication systems across international borders is achieved through the implementation of the Radio Regulations (RRs) and Regional Agreements, and the efficient and timely update of these instruments through the processes of the World and Regional Radiocommununication Conferences. The Radio Regulations (RRs), 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 Radiocommunicaiton Conference. 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

State. The implementation of these measures often requires actions in relation to the allocation and/or assignment of radio spectrum as discussed below.

3.18 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 the spectrum (usually in working groups of the CEPT).

#### 3.3.1.2 The allocation of radio spectrum in Ireland

3.19 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".*[19] 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.

3.20 ComReg's radio frequency plan for Ireland[20] (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.

#### 3.3.1.3 The assignment of radio spectrum in Ireland

3.21 The **assignment of** radio spectrum refers to the spectrum management activities that issues, and authorises the use of, such rights of use of radio frequencies[21].

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Decisions/Recommendations and their implementation status for all CEPT countries, including Ireland, is maintained at http://www.erodocdb.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

[19] Framework Regulations.

[20] ComReg Radio Frequency Plan for Ireland: ComReg Document 13/118R, last updated September 2015

[21] 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).

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 Telegraphy Acts.

3.22 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 same act. A wide range of devices have been made licence-exempt, including for example short ranges devices[22] (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 granted[23].

3.23 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.

3.24 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.[24] Further, ComReg is obliged to ensure that the issue of individual rights of radio frequencies is:

- based on objective, transparent, non-discriminatory and proportionate criteria[25]; and

[22] 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 March 2014.

[23] Regulation 9 (2) of the Authorisation Regulations.

[24] See regulations 9 and 11 of the Authorisation Regulations.

[25] Regulation 17 of the Framework Regulations.

- on foot of open, objective, transparent, non-discriminatory and proportionate procedures, which are required to be made publicly available[26].

### 3.3.2 Radio spectrum licences in Ireland

3.25 Figure 2 below presents the total number of radio spectrum licences in force (i.e. 'live' licences) in Ireland over the past 6 years, and highlights that the demand for licences continues to increase. As of 30 June 2015, the number of licences totalled 17,301, which represents a 3% increase over the 5 year period from 30 June 2010.

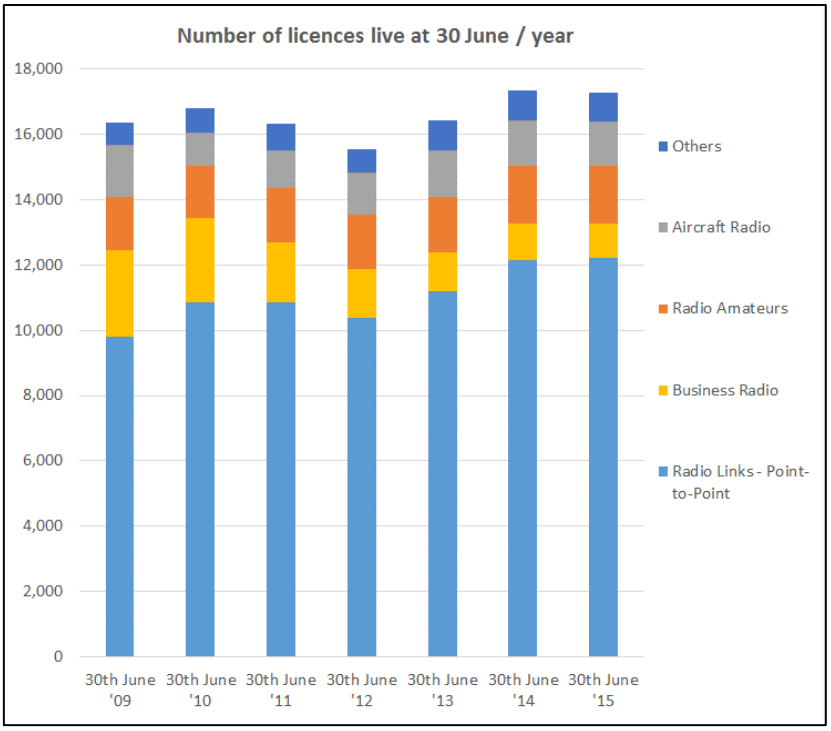


**Figure 2: Number of live licences for the period 2009 to 2015**

3.26 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 30 June 2015, there were 12,227 radio link point-to-point licences, representing circa 71% of all live licences. Point-to-point radio links are used mainly by fixed and mobile operators, broadcasters, utilities and emergency services to provide

[26] Regulation 9 of the Authorisation Regulations.

transmission capacity and networks[27], and to provide redundancy and back-up for other networks.

3.27 Licences for business radio, aircraft radio and radio amateurs are the next most voluminous licence type. As of 30 June 2015, there were 4,179 live licences for these services, representing circa 24% of all live licences. While the number of radio amateur and aircraft radio licences has remained relatively constant over the few years, the number of business radio licences has declined significantly from 2,682 licences in 2009 to 1,051 licences in 2015 (a 61% decrease over this 6 year period).[28]

3.28 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).

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

### 3.3.3 Monitoring, compliance and enforcement

3.30 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.

[27] 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.

[28] 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).

#### 3.3.3.1 Interference Investigation

3.31 In relation to the latter, investigation cases are prioritised by ComReg in terms of the impact and severity of the unauthorised use.

3.32 In that regard, particular attention is given to Air Traffic Control and emergency services given the safety-of-life implications. On average, there are 6 serious cases of interference per annum impacting Air Traffic Control and emergency services. Other notable areas in which interference can prove prevalent involves mobile phone networks[29] and disruption to fixed line DSL from non-compliant products[30].

3.33 In recent times, interference complaints have increased (see Figure 3 below). The number of interference investigation cases has increased, from 99 cases in 2010 to a projected figure of 207 cases in 2015 (a 109% increase)[31]. Analysis of these trends and discussions with stakeholders and licensees indicate that the upward trend in interference cases is likely to continue.

3.34 ComReg observes that this upward trend 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. Such services, like GSM (Global System for Mobile Communications) for example, could not provide high speed data. Later generations of communications standards, such as HSDPA (High Speed Downlink Packet Access) and LTE (Long Term Evolution), are generally not as robust in terms of the impact of interference, and so this is now having a more discernible impact on service quality.

[29] 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.

[30] 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.

[31] 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.

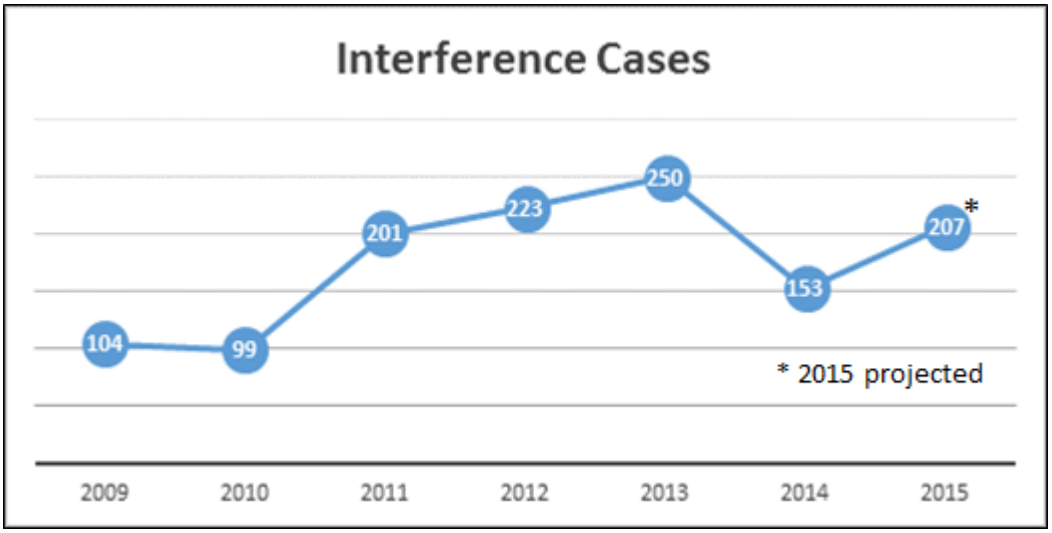


**Figure 3: The number of radio spectrum interference investigation cases**

#### 3.3.3.2 R&TTE & EMC Directives

3.35 Following the adoption of EU Decision 786/2008 [32] and EU Regulation 765/2008 [33], 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.

3.36 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 need to increase in the coming years, reflecting the ever increasing number of radio related devices entering the marketplace.

#### 3.3.3.3 Remote Monitoring

3.37 Since 2012, ComReg has been deploying its remote spectrum monitoring system throughout the country. The remote monitoring system gathers and stores data on spectrum usage which informs ComReg's spectrum management activities,

[32] 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.

[33] 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.

including the assessment of the occupancy of bands currently earmarked for release or repurposing, and the monitoring for any unauthorised use. In addition the system can assist in the investigation of cases of interference resulting in more efficient use of resources and quicker resolution times.

3.38 Currently, most of the main population centres in the country are covered (Dublin, Cork, Limerick, Galway, Waterford, Navan, Athlone, Castlebar, Sligo, Letterkenny) 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 addition, recent advents in software defined radio has allowed ComReg to begin research and development into tailor-made solutions for long and short term monitoring as well as interference investigation. This is an area that is in its infancy but is one that is likely to grow in importance and impact in the medium term.

### 3.3.4 Test and Trial Ireland

3.39 Ireland has a capability and reputation for research excellence in wireless innovation and technology.[34] There is an increasing base of enterprises and researchers engaging in wireless research activities covering the full continuum of research, from fundamental research to research 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.

3.40 ComReg promotes Ireland's strengths and opportunities in the wireless technology sector and the benefits associated with Test and Trial Ireland.[35] These opportunities arise primarily from Ireland's geographic position on the western edge of Europe and its low population density by providing 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

[34] 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.

[35] 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.

wireless technologies in a wide variety of frequency bands, including key parts of the radio spectrum used by mobile and broadcasting sectors.

3.41 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 others), Government, commercial organisations and research institutions to promote the benefits of Test and Trial Ireland to potential new clients.[36] 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 one of 54 company announcements made by IDA in the year. Similarly in 2014, one of 12 large scale SFI Research Centres, CONNECT, who partnered with another multi-national client used Test and Trial Ireland.[37]

3.42 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 environment[38], cognitive radio and an Internet of Things backbone using TV whitespace spectrum.[39]

3.43 Having regard to future trends, including the increased demands for advanced mobile services and potential impacts of the internet of things (IoT) and 5G etc, ComReg is committed to supporting Test and Trial Ireland to the benefit of returning and new Test and Trial Ireland clients.

[36] 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".

[37] 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.

[38] http://www.testandtrial.ie/Real_world_tests/230

[39] http://www.testandtrial.ie/Research_/231 and http://www.testandtrial.ie/Year_in_review__2014_/238

Chapter 4

# 4 Significant developments in radio spectrum use since 2011

4.1 In order to inform the spectrum management strategy consultation process, this chapter considers a number of significant radio spectrum management that have occurred in the Irish market since the previous spectrum management strategy statement was finalised in 2011.

## 4.1 Spectrum for mobile wireless broadband

### 4.1.1 The 2012 Multi-Band Spectrum Award

4.2 In 2012 ComReg completed its Multi-Band Spectrum Award (MBSA) process to release 140 MHz of paired spectrum in 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[40], with an additional 150 MHz being assigned almost doubling the amount of paired spectrum assigned (particularly in the sub 1 GHz bands, see Figure 4 below) and thereby facilitating the subsequent provision of new and improved services to consumers.

[40] A small proportion of the 1800 MHz band (3 spectrum blocks) remained unassigned in the time period 2013 to 2015.

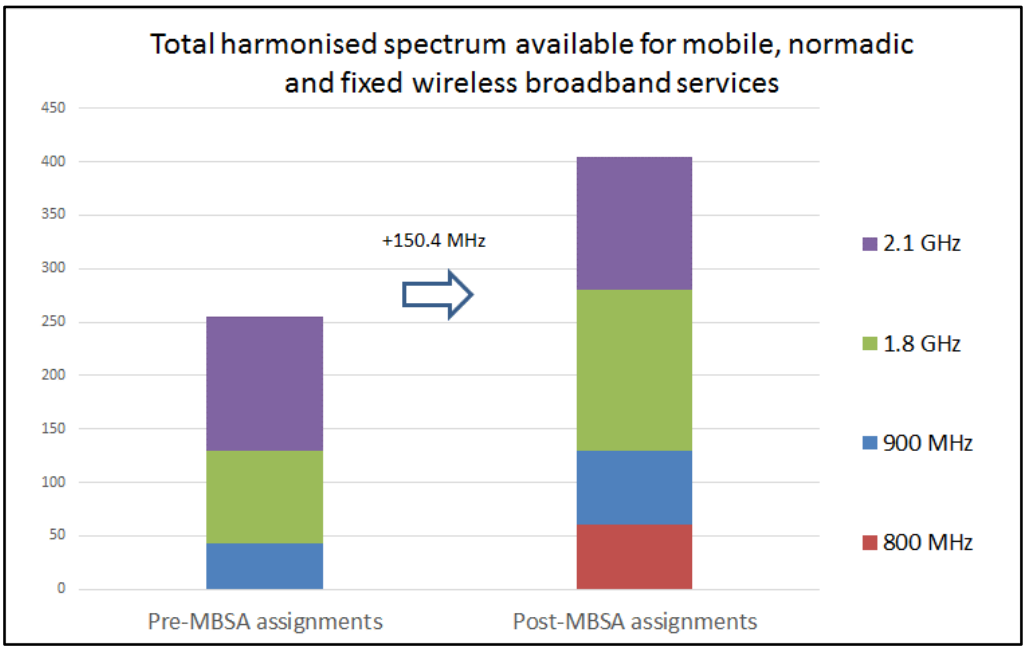


**Figure 4: The pre- and post-MBSA spectrum assignments**

4.3 The MBSA process was the subject of an extensive consultation process with a detailed consideration of many factors informing the final award design. A number of high level observations on the MBSA design and the post-award events are outlined below.

### MBSA design

4.4 A primary matter for consideration in the MBSA process was the bands for inclusion in the award process. While ComReg initially proposed an award process for a single band (the 900 MHz band), following consultation and an assessment of the other relevant spectrum bands available, ComReg modified its award design to cater for a multi-band approach.

4.5 In assessing the other bands for inclusion in the award process, it was notable that each of the spectrum bands was either substitutable and/or complementary, and that each band was available in a similar timeframe. Further, each of these bands benefited from technical harmonisation measures which promoted the wide availability of relevant consumer equipment (e.g. handsets) for mobile wireless broadband. Further, having a multi-band award process provided benefits to bidders as, during the auction, bidders were able to shift demand for spectrum rights between the bands in line with their preferences and in response to price changes between bands.

4.6 Another primary matter for determination by ComReg was the method of assigning the spectrum (or “award format”). In ultimately choosing an auction process, ComReg sought a competitive award process that was open,

transparent, proportionate and non-discriminatory, and one which facilitated and promoted market-based determination of award outcomes where appropriate. A combinatorial clock auction (CCA) was implemented for the MBSA process because, among other things, it:

- was considered to best address the "aggregation" risks that are involved when bidding on spectrum rights which are related to one another (e.g. spectrum rights in bands which are substitutable and/or complementary) so as to avoid the potential of bidders ending up with an undesired "combination" of spectrum rights;

4.7 facilitated bidders in revealing their true preferences in light of spectrum band pricing information which, in turn, enabled those bidders who valued the spectrum the most to obtain the spectrum rights of use; and

- was sufficiently flexible to address a number of other complicating matters[41] by way of market mechanisms, thereby reducing the need for (potentially imperfect) administrative decisions and, also, the potential for legal challenge.

4.8 In addition to determining the appropriate spectrum bands to be awarded and award format, ComReg consulted upon and implemented various measures relating to the detailed award rules and licence conditions (in furtherance of its statutory objectives, duties etc.) including:

- In respect of innovation, which was promoted by way of technology and service neutral licence conditions, the "early liberalisation option" etc.;
- In respect of safeguarding and the promotion of competition by way of measures such as its choice of the auction format and the imposition of competition spectrum caps etc.;
- In respect of ensuring the efficient use of spectrum by way of measures such as the requirement to pay both upfront and ongoing licence fees, licence conditions in respect of coverage and rollout, and an obligation to comply with rules to prevent spectrum hoarding which may be laid down by ComReg etc; and
- Protecting the interests of end-users by way measures such as ensuring an orderly transition by existing licensees and winning bidders to the

[41] Matters addressed by the award process included the:

- expiry of the existing licences at differing times via the use of two time slices;
- the liberalisation of the existing licences via the "early liberalisation option"; and
- the specific location of the radio frequency assignments via the assignment round.

outcomes determined by the award (i.e. the transition rules), quality of service licence conditions etc.

4.9 While there are many insights and observations that can be drawn in relation to the MBSA process, ComReg would highlight the following:

- The detailed and careful consideration of all relevant issues in the consultation process was central to ComReg's decision making, including the selection of the appropriate bands, the award design and the detailed conditions;
- The precise detailing of the award rules and conditions (in an Information Memorandum) in advance of the award process helped ensure an efficient award process as matters were considered and implemented by ComReg in accordance with pre-defined rules;
- Holding a single award process for multiple spectrum bands offered significant benefits. There are multiple factors to consider in assessing this matter, including:
    - the ability to include substitutable and complementary spectrum of similar timing availability in a single award process;
    - the ability to reduce common value uncertainty compared to holding one or more sequential awards;
    - the benefits of providing packaging options across multiple bands in a single award process[42];
    - the complexity and timing of the award process(es); and
    - the ability to facilitate efficient investment decisions by providing regulatory certainty regarding spectrum availability in a single award process;
- Facilitating market-based determination of award outcomes can be particularly beneficial by reducing the need for administrative decisions and lessening the potential for subsequent disputes or litigation.

[42] Such benefits include:

- allowing bidders to express synergistic values created by the inclusion of multiple bands (i.e. the package is likely worth more in total than its component lots if acquired separately);
- providing good options for bidders to obtain an efficient combination of coverage and capacity spectrum for the provision of services;
- reducing the possibility of any material consumer disruption arising; and
- increasing the potential for new entry.

4.10 While recognising that the specifics for each spectrum award will need to be considered and tailored on a case-by-case basis in light of the prevailing circumstances, ComReg notes that the MBSA auction resulted in the assignment of all long term rights of use in the band, without legal challenge and the delays to the provision of new and improved services to consumers this could have entailed, and where its outcome was welcomed by the winning bidders.[43]

### 4.1.2 Significant post-MBSA events

4.11 Following the completion of the auction in 2012, a number of developments occurred in the mobile marketplace relating to particular MBSA rules and licence conditions which ComReg outlines below.

The completion of two transition processes

4.12 Firstly, two separate transition processes were successfully completed. These processes refer to the existing licensees modifying their network equipment to the new frequency assignments as determined by the MBSA. ComReg observes that both of these transition processes were completed within a short time period, which minimised the delays (if any) to the introduction of new liberalised services. Further, no significant consumer service issues were notified to ComReg as a result of these transition processes.

4.13 Given this, ComReg considers that the practice of setting out detailed transition rules (including rules on how ComReg would treat any delays) in advance of the award process worked well as this provided clarity to existing licensees and winning bidders. Further, the active participation by existing licensees in the development of the transition plan is, in ComReg's view, another important factor likely to have significantly contributed to the success of these important transitions. These two high level observations may be useful in the design of any future transition processes such as might occur in other radio spectrum projects.

The rollout of new 3G and 4G services

4.14 ComReg also observes that, following the grant of technology- and service-neutral Liberalised Use Licences in the MBSA process, new 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

[43] See, for example:

- eircom Group Statement on Spectrum Auction (15 November 2012);
- Three welcomes the results of Ireland's spectrum auction (15 November 2012); and
- Vodafone Ireland Secures Winning Spectrum Combination (15 November 2012);

the 900 MHz bands[44] and 4G (or LTE) services were also introduced to the market in that year.

4.15 ComReg observes the adoption of technology and service neutral licence conditions facilitated this innovation, as this provided flexibility to the licensees in deploying the appropriate technology to best meet their end-user demands.

Mobile Coverage

4.16 Each of the mobile network operators (MNO) provide online maps showing their respective mobile coverage. All operators claim nationwide outdoor 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 85-90% of the population and, for 4G outdoor coverage Vodafone claims over 90% population coverage[45] while eircom claims 67% population coverage.[46]

4.17 ComReg 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 part 4(3) of the schedule of the Liberalised Use licences granted on foot of the MBSA process. This suggests to ComReg that mobile coverage is driven primarily by competitive forces and, in this regard, ComReg notes that each MNO's website uses coverage as a factor by which to attract and retain customers.

4.18 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 87% population in December 2014 is above the EU average of 79% population coverage[47].

Mobile data usage

4.19 Since 2011, data usage on the mobile networks has increased significantly. While mobile voice services have increased by just under 10% in the period Q2 2011 to Q2 2015, mobile data usage has increased by almost 500% (see Figure 5 below).

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

[45] http://www.vodafone.ie/network/ (16 September 2015)

[46] eircom Fourth Quarter and Full Year Results (September 1, 2015)

[47] See slide 12 of http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=9929 (Digital Agenda Scorecard 2015) https://ec.europa.eu/digital-agenda/download-scoreboard-reports

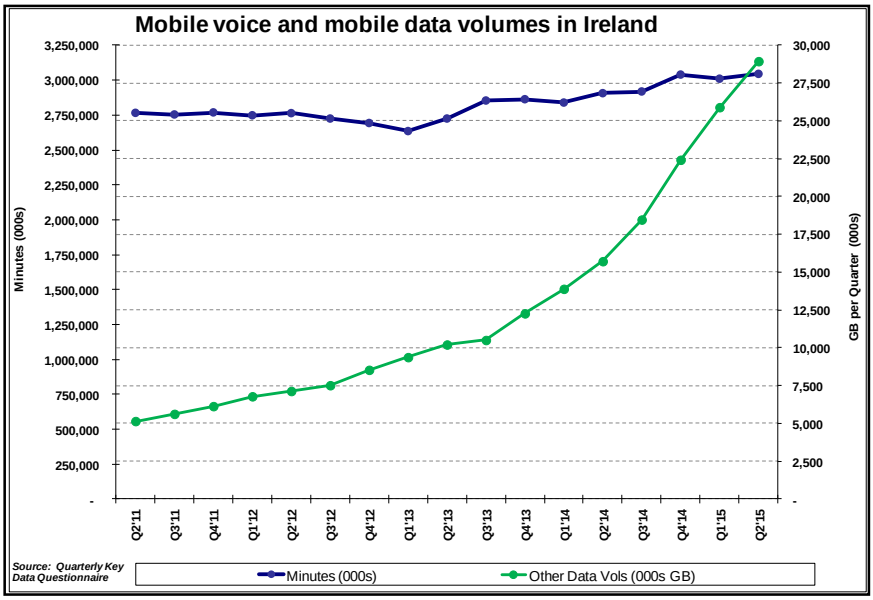


**Figure 5: Trend of mobile data volumes Q2 2011 to Q2 2015**

4.20 Further, as of June 2015, the average traffic per smartphone user reached 1.8 GB of data per month, while the average traffic per dedicated mobile broadband subscriber was 7.1 GB of data per month. When compared with the 2011 usage figures of 200 MBs (smartphones) and 2.5 GBs (mobile broadband) per month, this represents an 87% year-on-year increase for smartphone usage and a 36% year-on-year increase for mobile broadband usage.

4.21 ComReg observes that this increase is likely due to a number of factors including:

- Increased 3G and 4G network capability and coverage;
- Increased smartphone penetration - currently around 82% of the "market"[48];
- Rising mobile data caps, and "all you can eat" plans; and
- The increasing use of video and over the top (OTT) applications.

4.22 User demand for mobile data is expected to further increase as the penetration of devices (particularly 4G smartphones) increases and the capabilities of these devices increase. A recent report for ComReg by Frontier Economics has conservatively estimated that, between 2015 and 2035, user demand for mobile data will increase 33 times[49] as illustrated in Figure 6 below.

[48] ComReg Quarterly Report Q3/15 (Document 15/130). 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).

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

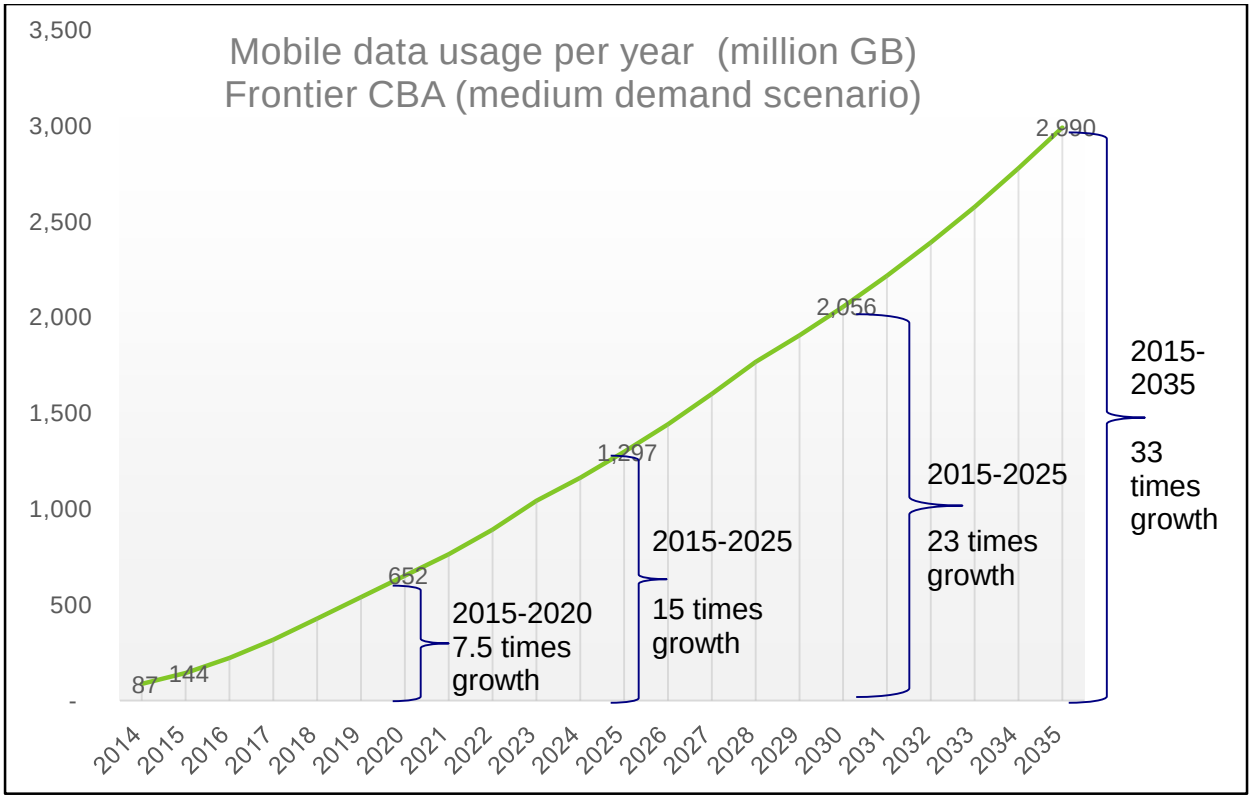


**Figure 6: Predicted total mobile data usage per year (million GB), Frontier CBA (medium demand scenario)**

### 4.1.3 Collaboration agreements between MNOs

4.23 In 2011 and 2012, two collaboration agreements were agreed between MNOs:

- first, eircom Ltd (now eir) and Telefónica Ireland Limited (now Three Ireland Services (Hutchison) Limited or "Telefónica") announced a strategic network partnership that brought greater co-operation in a number of areas encompassing site equipment, power supply, technology and transmission sharing;[50] and
- subsequently, Vodafone Ireland Limited (Vodafone) and Hutchison 3G Ireland Ltd (now Three Ireland (Hutchison) Ltd or "Three") announced the formation of a 50/50 joint venture company to manage the shared physical infrastructure.[51]

4.24 Press releases in respect of the agreements highlighted, among other things, the benefits for consumers, such as the introduction of new technologies to provide

[50] eircom and O2 Announce Strategic Network Partnership (06 April 2011)

[51] Vodafone Ireland And Three Ireland Announce Strategic Partnership To Share Network Infrastructure (13 July 2012)

customers with wider and faster broadband speeds and the opportunity to expand mobile network coverage.

4.25 Following the acquisition of Telefónica by Hutchison in 2014 (see below), a new collaboration agreement was concluded between eircom and Three, while the Vodafone and Three collaboration arrangement was terminated.

### 4.1.4 The acquisition of Telefónica by Hutchison

4.26 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. [52]

4.27 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 Hutchison[53] in response to the competition concerns identified by the EC[54].

4.28 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.

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

- *"monitor the competitive dynamic of the mobile markets affected; and*

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

[53] 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

[54] 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."*

- *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

4.30 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[55], the impact of which remains to be seen.

### 4.1.5 The judicial review proceedings - JR 2014/595/JR

4.31 From February 2014, ComReg interacted with Vodafone relating to requests from Vodafone that ComReg take certain positions and actions in relation to the exercise of its radio spectrum management powers in the context of the above proposed acquisition.

4.32 On 13 October 2014, Vodafone sought and was granted leave to bring judicial review proceedings. In summary, Vodafone brought its case because it did not believe that ComReg had exercised its spectrum management function in the context of the proposed acquisition.

4.33 ComReg, for its part, maintains that it has at all times been mindful of its statutory functions, duties and obligations and, in this regard, prior to the acquisition, in the context of the acquisition and in the aftermath of the acquisition, it has exercised, and continues to exercise, its spectrum management function appropriately, in the context of all spectrum bands including those at issue.[56]

[55] Dixons Carphone Warehouse (20 August 2015) and Virgin mobile (5 October 2015)

[56] In particular, ComReg assessed the Merger from a spectrum management perspective and continues to monitor spectrum use in Ireland (including as it may be affected by the acquisition) in accordance with its relevant statutory functions, duties and obligations. In summary:

- *ComReg has put in place a regulatory regime to ensure and incentivise efficient spectrum use. In particular ComReg, via the spectrum licensing regime, put in place various specific ex-ante measures to ensure on-going efficient use of spectrum in the relevant bands and in particular coverage and roll-out obligations and the payment of upfront spectrum access fees and ongoing spectrum usage fees;*
- *ComReg continues to monitor and supervise compliance by all of the MNOs with the conditions attached to their respective licences, including those identified above;*
- *ComReg continues to monitor and supervise compliance by all of the MNOs with the provisions of the Regulatory Framework; and*

4.34 On 12 June 2015, ComReg and Vodafone agreed to strike out the judicial review proceedings (see ComReg Information Notice 15/56). ComReg observed that in the carrying out of its spectrum management function, a public review in respect of concerns expressed by an undertaking is unlikely to be undertaken in circumstances where there is no *prima facie* basis for it.

4.35 ComReg also took the opportunity to confirm that:

- *administrative matters concerning the spectrum divestment aspect of the Commitments will be addressed by ComReg at the appropriate time (e.g. if and when the commitment to divest spectrum is likely to be exercised) and will depend on what is proposed by the relevant parties in accordance with the terms of the Commitments. These matters cannot be addressed until this time;*
- *ComReg will soon publish its consultation on its spectrum strategy statement, which will set out its current thinking on matters relevant to the effective management and efficient use of the radio spectrum generally (including, making available additional spectrum rights, award process matters including competition-based spectrum caps (having regard to existing spectrum holdings) trading of spectrum rights, duration of spectrum rights, conditions attached to spectrum rights, collaboration between wireless operators and publication of information concerning radio spectrum);*
- *ComReg will publish this summer its proposals for the award of rights of use in the 3.6 GHz band, as outlined by ComReg in Information Notice 15/14;* and
- *ComReg expects to publish its response to Consultation 14/65 concerning the liberalisation of the paired terrestrial 2GHz spectrum band later this year.*

4.36 In relation to the above points, ComReg observes that:

- administrative matters concerning the spectrum divestment aspect of the Commitments will be addressed by ComReg at the appropriate time;
- Consultation 15/70 has been issued in relation to the 3.6 GHz band;
- This document sets out ComReg's consultation on its spectrum management strategy; and

- *ComReg regularly meets with the MNOs to discuss relevant matters such as market trends, deployment of new technologies, coverage levels etc.*

- The response to Consultation 14/65 remains a work plan item for ComReg, as discussed in chapter 5 of this document.

### 4.1.6 The introduction of a spectrum transfer framework

4.37 In 2014 ComReg finalised its framework (procedures and guidelines) concerning the transfer of rights of use to spectrum in the bands set out in the Radio Spectrum Policy Programme (RSPP) Decision[57] (Document 14/11). In addition, spectrum transfer regulations were adopted into law.[58]

4.38 To date no transfers have been notified to ComReg in accordance with this transfer framework. Instead ComReg notes that in Ireland and many other European markets, the transfer of spectrum rights of use is mainly taking place in the context of overarching corporate transactions involving spectrum rights holders (i.e. mergers or acquisitions).[59]

4.39 In the responses submitted to Document 15/70[60], ComReg observes that many respondents suggested the use of leasing as a mechanism for improving the efficient use of spectrum.

4.40 ComReg observes that the leasing of rights of use to radio spectrum used for the provision of ECS is provided for as part of the RSPP Decision and the Common Regulatory Framework. ComReg is presently considering the setting out of a spectrum leasing framework for the RSPP bands within the 2016 to 2018 timeframe (see chapter 5).

### 4.1.7 Potential for further spectrum releases

4.41 In line with ComReg's key priorities on radio spectrum use as set out in its strategy statement on Electronic Communications (Document 14/75), and given factors such as the increasing demand for mobile services, the ongoing harmonisation activities in the spectrum bands for (mobile) wireless broadband, and the availability of these bands, ComReg has progressed a number of items with a view to the further release of relevant spectrum rights.

4.42 These items projects include:

[57] Decision 2012/243/EU of the European Parliament and the Council concerning Radio Spectrum Policy Programme (RSPP).

[58] The Wireless Telegraphy (Transfer of Spectrum Rights of Use) Regulations 2014 (S.I. No. 34 of 2014).

[59] See RPSG 15-621rev draft opinion on the implementation of the current RSPP (section 4.3.2.3)

[60] ComReg Document 15/106

- Consultation 14/101 on the potential spectrum award of the 2.6 GHz band with the possible inclusion of 700 MHz, 1.4 GHz, 2.3 GHz and 3.6 GHz bands;
- Information Notice 15/62 in which ComReg sets out its view that the 700 MHz band can and should be repurposed for other services in line with relevant international harmonisation measures, as this would represent its most efficient use; and
- Consultation 15/70 on the potential award of the 3.6 GHz band where ComReg indicated its intention to issue a response to this consultation by the end of 2015.

## 4.2 Spectrum for other radio services

4.43 Aside from developments in relation to spectrum for (mobile) wireless broadband, a number of significant developments have also occurred in relation to the other radio services. [61]

### 4.2.1 Closure of the 13 and 15 GHz spectrum bands for new radio links licences in the congestion area of Greater Dublin

4.44 Radio links are commonly used for providing a high bandwidth connection between two fixed points and, in some circumstances, for providing an alternative to optical fibre connections. In Ireland, a large number of radio spectrum bands are allocated to and used for fixed radio links. ComReg has an established process for considering applications for radio links in a variety of key bands (see Document 98/14R).

4.45 In April 2014, ComReg closed the 13 GHz and 15 GHz spectrum bands to new radio link applications in the congestion area covering certain parts of Greater Dublin because of the exhaustion of all available channels within the congested area (see Information notice 14/32).

4.46 Further, ComReg observes that as of January 2015:

[61] Aside from the developments discussed in this chapter, other items include:

- a new telemetry network monitoring licensing scheme was established in 2014 and ESBN was awarded 2 blocks and Irish Water was awarded one national block.
- ComReg's Test and Trial Ireland licensing regime facilitated another world's first test of what is considered to be the longest IoT backbone connecting a mesh of sensors in Dublin City to the Intel Labs Europe campus on the outskirts of Dublin using TV white space spectrum. http://www.testandtrial.ie/NewsDetails/21#.VcnTaXFVhHw Intel Vote of confidence in Test and Trial Ireland.

- circa 29% of all radio link licences concern links in the Greater Dublin region, while circa 6% of all links are in the Cork region, and circa 4% in the Limerick and Galway regions;
- in the urban areas, particularly in the defined congested area in the Greater Dublin region, demand for new radio links appears to have shifted towards higher frequency bands. This may be due to an exhaustion of the existing channels in the lower frequency bands or the ability for the higher frequency bands to meet the users' demands[62]. Outside of Dublin demand is spread across all frequency bands; and
- circa 22% of all live radio links licences were in the 38 GHz band, while strong demand was also evident in the 13 GHz (circa 12% of all licences) and 15 GHz bands (circa 17% of all licences).

4.47 No congestion charge currently applies to the 13 GHz and 15 GHz frequency bands, but ComReg notes that such a measure could be explored as a means of appropriately managing congestion issues.

### 4.2.2 The switchover from analogue to digital terrestrial television

4.48 In 2010, free-to-air digital terrestrial television (DTT) was introduced into Ireland alongside the existing analogue terrestrial television service. Following a short switchover period of circa 2 years, in October 2012 Ireland's analogue terrestrial television network was then switched off ending more than 50 years of analogue TV broadcasting. This digital switchover required careful preparations as it represented a technology changeover on a national basis.

4.49 A key element in these preparations was the announcement, on 29 July 2010, by the Minister for Communications, Energy and Natural Resources that the analogue switch-off (ASO) of terrestrial television would occur in the State in Quarter 4 of 2012, in conjunction with analogue switchover in Northern Ireland. This announcement provided clarity on both the DTT and ASO processes in Ireland at that time, and was significant in facilitating a re-plan of the UHF band for DTT services below 790 MHz.

4.50 In collaboration with radio spectrum planners from the BAI and RTÉ/2rn, ComReg prepared a re-plan of the UHF band for DTT services and the coordination of this plan was finalised with the UK in June 2012. This plan was significant as it resulted in all the existing and planned DTT services being

[62] For example, the radio link licences offered in the 38 GHz band are available on a wideband basis (56 and 112 MHz bandwidths) whereas the lower frequency bands are available only on narrow/medium bandwidth basis (3.5 and 7 MHz).

accommodated below 790 MHz, thereby freeing the 800 MHz band (790 to 862 MHz) for release.

4.51 Another important element in this process was the preparations for the all-island switch-off of analogue television which took place on 24 October 2012. In Ireland, public information campaigns were run by the DCENR and RTÉ using various media[63]. These were a central element to the successful ASO process as they raised consumer awareness of the switchover to DTT and the date of ASO.

4.52 The all-island approach to the switch-off also provided benefits, particularly for the radio frequency planning and consumer information campaigns:

- In relation to radio frequency planning, the all-island approach simplified the planning by avoiding the scenario where one jurisdiction would be using frequencies for analogue television. This eased the transition to the new UHF radio frequency plan where all DTT services were provided for below 790 MHz. The all-island approach also facilitated the coverage of DTT services on both sides of the border, via overspill and the Northern Ireland multiplex; and
- In relation to the consumer information campaigns, the all-island approach facilitated the co-ordination of these campaigns in both jurisdictions in terms of delivery and content. This simplified the message to consumers, particularly those in the border areas, and reduced the potential for consumer confusion via the receipt of differing messages.

4.53 Overall, the switchover from analogue to DTT services in 2012 was a successful process because of various key elements. Further, given the increased spectral efficiency of the digital services, ASO resulted in a “digital dividend” to both the broadcasting and mobile sectors because:

- the DTT service allowed several programming content channels to be broadcast on one frequency at the same time, thereby facilitating the broadcasting of additional channels and content; and
- the re-plan of the UHF band that provided for DTT services below 790 MHz freed valuable radio spectrum in the 800 MHz band for release. As discussed earlier this spectrum band was included in the MBSA process.

[63] Media advertising and airtime, information booklets, leaflets and point of sale material, co-promotions with retailers, website information, call centre helpline, etc.

### 4.2.3 Broadcast frequency planning in the UHF band since WRC-12

4.54 At WRC-12[64], 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.

4.55 While Ireland has yet to adopt this allocation, significant preparations have been carried out in relation to the spectrum planning of the DTT service.

4.56 Both the DCENR[65] and ComReg have begun considering the future of the 700 MHz band and in June 2015 ComReg issued the results of a cost benefit analysis (CBA)[66] which estimated a positive NPV of €91m in a change of use to mobile. Noting this outcome and the increasing international impetus towards 700 MHz repurposing, ComReg outlined its view that Ireland can and should repurpose the 700 MHz band in line with international harmonisation measures.

4.57 To facilitate any future repurposing of the 700 MHz band, and in collaboration with the BAI and 2rn, ComReg is working on a revised UHF band plan to migrate DTT services below the 700 MHz band. This plan is also in the process of being coordinated with neighbouring administrations, particularly the UK[67], and it is ComReg's aspiration that a coordination plan be completed by Q2 2016.

4.58 With regards to any future actions, ComReg observes that a migration of DTT services from the 700 MHz band is likely to require similar preparations to those used in the 2012 switchover process from analogue television to the DTT service as discussed above. ComReg will continue to engage with relevant stakeholders with a view to making further progress on this important spectrum band.

[64] WRC-12 is the acronym for the World Radiocommunications Conference held in Geneva in 2012.

[65] The uses of the UHF band from 470 - 790 MHz is being considered in the DCENR's consultation on spectrum policy

[66] See ComReg Documents 15/62, 15/62a and 15/62b

[67] Note, Ireland and the UK are also members of the Western European Digital Dividend implementation Platform (WEDDIP) group - a multi-lateral group of radio spectrum planners from Belgium, France, Germany, Ireland, Luxembourg, the Netherlands, Switzerland and the United Kingdom. The WEDDIP aims to complete its work in H1 2016.

Chapter 5

# 5 Demand for radio spectrum

5.1 This chapter discusses the potential radio spectrum demand of specific radiocommunication service categories.

## 5.1 Background

5.2 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.

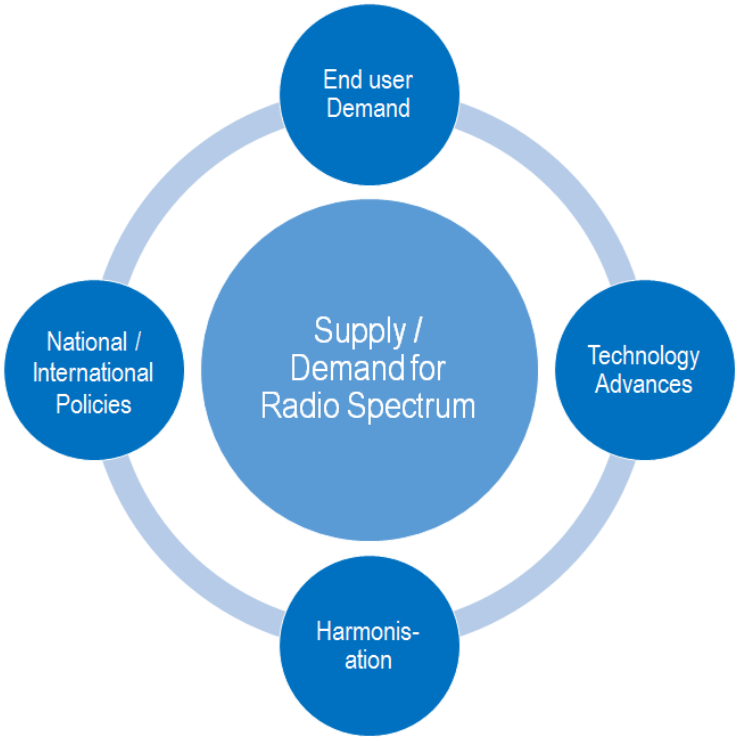


**Figure 7: Background factors affecting supply and demand for radio spectrum**

5.3 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.

### 5.1.1 End user demand

5.4 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 demand for radio spectrum for real-time global flight tracking of aircraft as recently agreed at WRC-15[68];
- the demand for spectrum for mobile wireless broadband has been revised upwards in recent years[69] and, as a result, the RSPP Decision seeks to identify at least 1200 MHz of suitable spectrum by 2015.

#### Paradigm shift: Mobile smartphone use case

5.5 Future mobile traffic growth rate will be significant 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.[70]

5.6 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.

5.7 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.[71]

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[68] 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

[69] 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 June 2015, the average traffic per smartphone user was 1.8 GB of data per month. In 2011, this figure was 200 MBs per month.

[70] 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 and 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.

[71] 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 Gpbs downlink and 100Mbps uplink.

### 5.1.2 Technology changes and advancements

5.8 Technology changes[72] 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 the radio spectrum and in some instances this can result in faster or higher quality services being provided which may be sufficient to addressing an increasing end user demand for services. In other instances this can result in spectrum being released from one service to another.[73]

5.9 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.

### 5.1.3 International harmonisation of radio spectrum

5.10 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.

5.11 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.

5.12 In ComReg's experience, the appropriate release of harmonised spectrum bands has proven to be generally very successful in facilitating the delivery of services

[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.

to end-users.[74] On the other hand, the release of non-harmonised spectrum bands has proven to be less successful.[75]

5.13 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 generally set a forward looking work programme and this provides an indication of future harmonisation measures. For example see the work plans of CEPT[76] and RSPG.[77] In some instances, harmonisation decisions are obligatory on Member States thereby directly increasing the supply of spectrum at a national level with a defined timeframe.[78]

5.14 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].

[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] IEE802.16a is the technical reference for the fixed wireless WiMax standard promoted by this Forum.

### 5.1.4 International and national policies

5.15 At a European level, ComReg observes that the Europe 2020 growth strategy[80] (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.

5.16 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.

#### Ireland's National Broadband Plan

5.17 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 and its consultation of July 2015 proposed that 60% of the premises in the Intervention Area are covered by December 2018 and 100% by December 2020.[81]

5.18 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 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

5.19 Having considered some of the general factors that affect the radio spectrum environment, the following section discusses the likely demand of specific radiocommunication services for spectrum within the next 5 years.

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

[81] http://www.dcenr.gov.ie/communications/SiteCollectionDocuments/Broadband/Strategy%20Reports/Proposed%20Intervention%20Strategy.pdf

### 5.2.1 Mobile, nomadic and fixed wireless broadband services

5.20 Mobile, nomadic, and fixed wireless broadband services play an important role in the Irish telecommunications sector. ComReg's most recent quarterly report for Q3 2015 (Document 15/130) indicates, among other things, that there were:

- 5,833,464 mobile subscribers (including mobile broadband and Machine to Machine (M2M)) - a mobile penetration rate of 124.9% of the population. From this number there were:
  - 4,026,025 voice and call subscribers using 3G/4G networks (up 12% from Q2 2015);
  - 417,935 mobile broadband subscriptions (HSDPA and LTE, up 1.3% from Q2 2015); and
  - 521,277 (M2M) subscriptions (up 4.9% from Q2 2015); and
- 44,628 Fixed Wireless Access (FWA) broadband subscribers (down -3.3% from Q2 2015).

5.21 These services are provided using a variety of licence types issued by ComReg including the Liberalised Use Licences in the 800 MHz, 900 MHz and 1800 MHz band, 3G Licences in the 2 GHz band, and FWALA licences in the 3.6 GHz, 10.5 GHz and 26 GHz bands.

5.22 ComReg has also issued licences in non-harmonised bands which can facilitate the provision of wireless broadband services. To ComReg's knowledge, however, no commercial services have been launched. These licences are:

- Wideband Digital Mobile Data Services (ComReg Document 05/79) using radio frequencies at 410 – 412 MHz paired with 420 – 422 MHz and 412 – 414 MHz paired with 422 – 424 MHz; and
- Wireless Access Policy for Electronic Communications Services using radio frequencies at 1785 to 1805 MHz (ComReg Press Release 27 April 2007 and Statutory Instrument no. 172 of 2007).

5.23 As discussed in chapter 3, the user demand for mobile wireless broadband services has increased significantly in recent years (see Figure 5 above) and growth forecasts for mobile wireless broadband traffic predict further significant increase in mobile traffic, particularly as the penetration of devices (particularly 4G smartphones) and its capabilities increase. The recent report for ComReg by Frontier Economics has conservatively estimated that between 2015 and 2035, user demand for mobile data will increase 33 times[82] (see Figure 6 above). In

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

carrying out this work, Frontier examined analysts' forecasts of UK demand for mobile data and ComReg observes that these forecasts are of a similar magnitude to Frontier's projections for Ireland. Such increases in end-user demand will likely result in increased demands for spectrum.

5.24 At an international level, harmonisation measures have been recently been adopted by CEPT (e.g. 700 MHz, 2.3 GHz) and the EC (e.g. 1.4 GHz) to identify and make available more harmonised radio spectrum that can be used for mobile wireless broadband, and further harmonisation measures are expected (e.g. an EC decision on the 700 MHz band).[83] 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 8 below presents information on 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 15/70 and 14/101.[84] 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).

[83] The consideration of additional spectrum for International Mobile Telecommunications (IMT) is also being considered at WRC-15 under agenda item 1.1.

[84] 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.

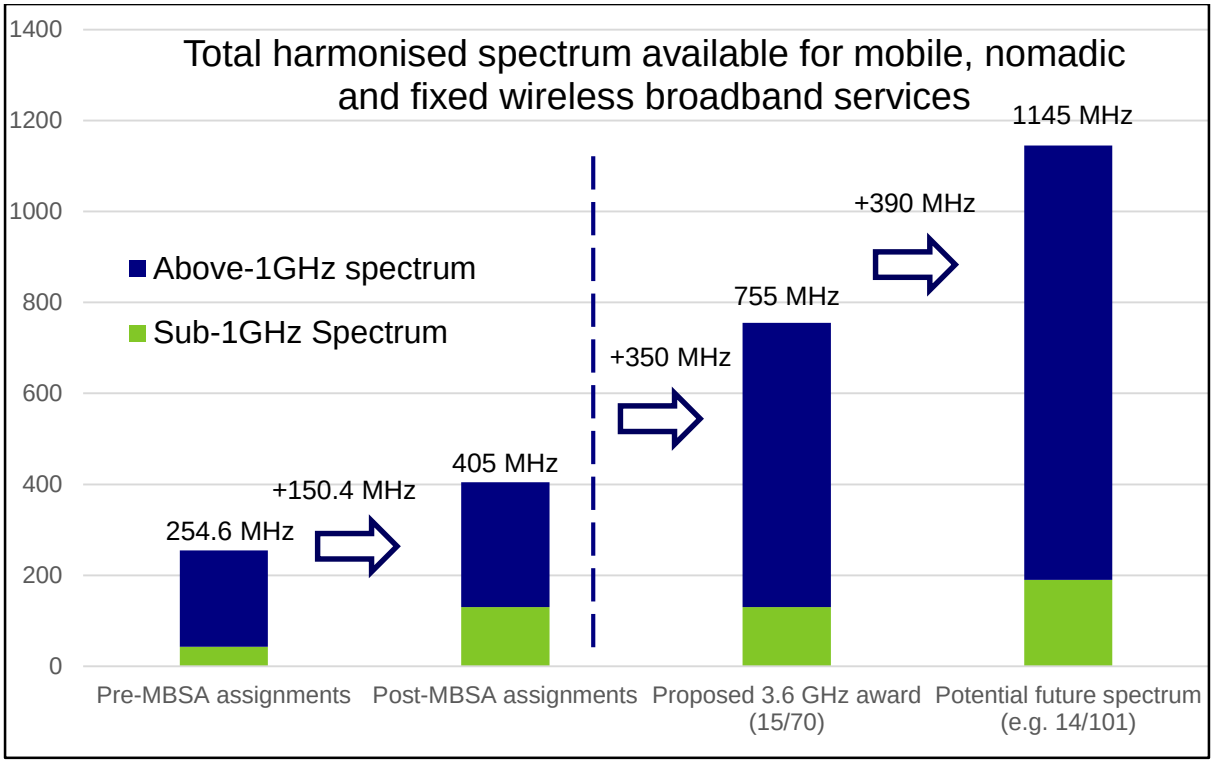


**Figure 8: Total amount of harmonised spectrum for mobile, nomadic and fixed wireless broadband services under ComReg's proposed award processes of Documents 15/70 and 14/101**

5.25 Advances in technology may also help address increasing end-user demands. For example, the aggregation of spectrum carriers (both intra-band and inter-band carrier aggregation) has been introduced by Irish MNOs, and increasingly end-user demand is moving towards the more spectrally-efficient LTE (4G) technology.

5.26 With the expected delivery of the NBP project over the coming years, backhaul connectivity within the country is also likely to improve. From a mobile wireless broadband perspective, the availability of better backhaul may assist the deployment of additional sites or the densification of networks (e.g. via small cells) within urban areas. This also may go some way towards addressing increases in end-user demand.

### Future services including 4G+ and 5G

5.27 On a longer term basis, it is expected that the mobile technology will continue to evolve from 4G services to advanced 4G+ services and new mobile wireless technologies, such as 5G services, will also be developed. Figure 9 below outlines a proposed 5G roadmap from the EC 5GPPP[85] organisation and this

[85] https://5g-ppp.eu/

suggests that new releases for 4G will continue to occur on a regular basis between now and 2020, and that while trials of 5G are occurring[86], 5G deployment and commercialisation would only likely occur after 2020.

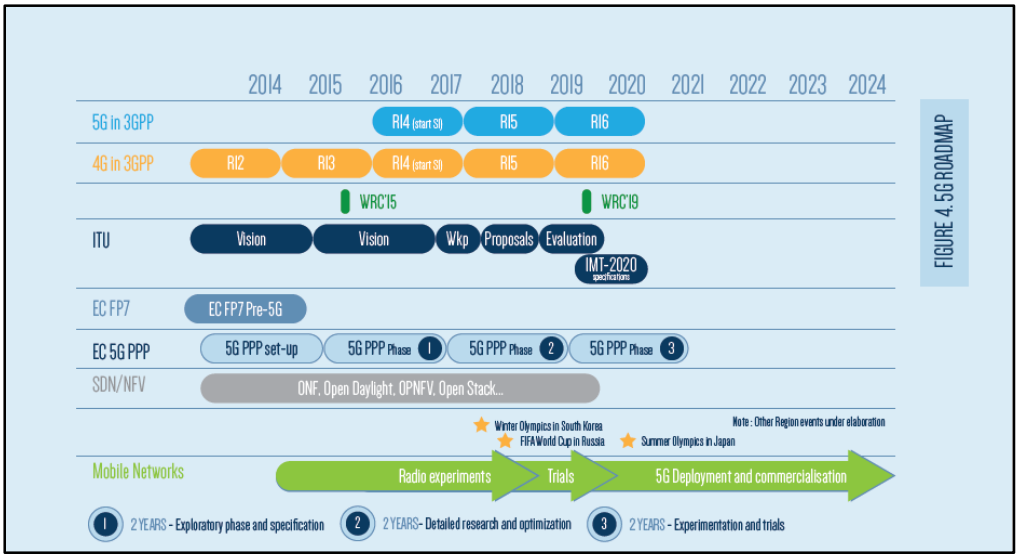


**Figure 9: Proposed 5G Roadmap (5g-ppp.eu/roadmaps)**

5.28 The expected characteristics of 5G systems are diverse but some requirements are that 5G could boost wireless speeds (10 to 1000 times faster), cut latency, save on energy usage, accelerate innovations, enable higher security networks and deliver seamless connectivity (5GPPP). Many international bodies (including the ITU, EC 5GPPP, 3GPP, EU, RSPG, and CEPT[87]) are now considering the spectrum demands for 5G and it is expected that spectrum bands above 6 GHz will need to be considered in order to support the requirements for wide contiguous bandwidths. This item is under consideration at WRC-15 in relation to the list of items to be included in the agenda of the next WRC in 2019.

5.29 Other LTE technology advancements are also being developed, including LTE-U (for use in licence-exempt radio spectrum), eLTE (dedicated for use by services with high resilience requirements such as by emergency services) and eMBMS (a more efficient way to provide broadcast mobile TV services). The impact of these advances on end-user demand and spectrum requirements is uncertain at this point.

[86] For example, Huawei demonstrated 3.6Gbps speeds with new RAN technology in a live field environment on a sub-6GHz frequency using a 100 MHz band channel, (http://telecoms.com/446111/huawei-demonstrates-3-6gbps-speeds-with-new-ran-tech/ 7 October 2015)

[87] For example, spectrum for 5G has been identified as an activity in the CEPT and RSPG work programmes. The EU has signed 5G co-operation agreements with South Korea and China.

### 5.2.2 Broadcasting

5.30 The provision of broadcasting services via radio spectrum remains an important service in Ireland. For example:

- data from the Nielsen TV Audience Measurement Establishment Survey[88] for September 2015 indicates there are 1.578 million TV households in Ireland, with the majority of these households receiving a TV service using radio spectrum provided via a DTT or satellite service;
- listenership research conducted by the Joint National Research industry body for the period October 2014 to September 2015 indicates the importance of sound-broadcasting in Ireland with daily radio listening at 83%.[89] Sound-broadcasting services are provided via various platforms including the analogue radio service in the FM band.

5.31 Radio broadcasting services are provided under various licences issued to RTÉ, the public service broadcaster established under the Broadcasting Authority Act 1960 (as amended), and the Broadcasting Authority of Ireland (BAI), established under the Broadcasting Act 2009, which is responsible for the authorisation of Irish broadcasting services other than those provided by RTÉ.

5.32 The BAI is also responsible for the regulation of broadcast content within Ireland. ComReg is responsible for the allocation, assignment and licensing of the associated radio frequencies under various broadcasting legislation and continues to work in close cooperation with both the BAI and RTÉ on the assignment of spectrum to ensure its efficient use.

5.33 While consumers are increasingly using other platforms as a way of consuming broadcasting services (e.g. the use of internet TV and internet radio for live or catch-up programmes), ComReg observes that the demand for broadcasting services provided via radio spectrum has remained strong over the last number of years and is likely to remain so in the short-to-medium term.[90]

5.34 Over time, advancements in services which require greater data rates (such as advances in picture resolution like High Definition or Ultra High Definition) may see an increase in the demand for spectrum in the UHF band. Ireland's current

[88] http://www.tamireland.ie/

[89] http://info.ipsosmrbi.com/assets/files/jnlr/top-line_data/14-086646-Oct'15-Press%20Release-FINAL.pdf

[90] For example, the DCENR report on future use of UHF spectrum for broadcasting in Ireland (May 2014) recommends that the UHF spectrum remain allocated for broadcasting services until at least 2025, while the provision of spectrum for such purposes beyond this date will be subject to review in light of technological, market, and regulatory developments in a timely manner in advance of this date.

use of two DTT multiplexes suggests that there is sufficient scope for new and advanced DTT services within the UHF spectrum, given that Ireland's revised UHF band spectrum plan for DTT is being re-planned to accommodate up to 6 DTT multiplexes below the 700 MHz band. In addition, the introduction of new DTT technologies can help mitigate this demand, as technologies such as DVB-T2 developed by the European DVB Project and advances in compression technologies, H.264/HEVC and H.265/HEVC standardised by ETSI, offer potential for further spectrum efficiency gains[91].

### 5.2.3 Radio links

5.35 Point-to-point radio links are used mainly by fixed and mobile operators, broadcasters, utilities and emergency services to provide transmission capacity and networks[92], and to provide redundancy and back-up for other networks.

5.36 ComReg has an established process for considering applications for radio links in a variety of key bands in line with CEPT or ITU-R harmonisation recommendations (see Document 98/14R), and as of June 2015, there were 12,227 fixed link licences in Ireland.

5.37 As end-user demand for data services increases, the demand for higher transmission backhaul capacity for networks will also increase. This could translate into a demand for more radio links, radio links with higher bandwidth channels or additional spectrum bands for radio links. This demand could also be met by other platforms such as fibre.

5.38 Recently, both the CEPT and RSPG considered wireless backhaul at a European level. ECC Report 173[93] considered the fixed service in Europe and noted that some spectrum bands (13 GHz, 15 GHz, 18 GHz, 23 GHz, 38 GHz) were showing rapid growth in terms of number of links, while others have yet to take off (32 GHz, 50 GHz, 70/80 GHz, 92 GHz). This report also highlights that the CEPT proactively responds to the industry demand for efficient usage fixed services bands. In that regard, ComReg observes that new or revised fixed service recommendations are regularly issued by CEPT.

[91] The current minimum specification for Saorview does not require DVB-T2. However, the preceding compression technology, MPEG4 AVC (H.264), is a mandatory requirement on all receivers sold in Ireland facilitating services such as HD. See http://www.2rn.ie/wp-content/uploads/2014/05/Irish-DTT-receiver-spec-V5.pdf

[92] 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 fundamental 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.

[93] http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCRep173.PDF (March 2012)

5.39 The RSPG report on spectrum issues for wireless backhaul[94] considered the strategic spectrum challenges for wireless backhaul and small cell issues for the next 5 to 10 years. This report concluded that:

- in the mid-term, the backhaul requirements for mobile networks can be fulfilled using the current CEPT harmonised fixed service frequency bands; and
- in the longer term, new frequency bands might need to be designated for fixed service applications and new channel plans for wideband systems might need to be introduced in the current CEPT harmonised fixed service frequency bands. Furthermore, different kinds of licensing approaches might need to be considered, and the feasibility of sharing between mobile and fixed service networks in the same frequency band might need to be assessed.

5.40 Compared to many other European countries, radio links are more extensively used in Ireland and since 2010 there has been a 12% increase in the number of point-to-point radio link licences. This suggests that in Ireland the demand for radio links may continue to increase in the short to medium-term, although this may also depend on other factors such as the availability of fibre. Having regard to national demand and circumstances, ComReg observes that the radio link process (ComReg Document 98/14R) may need to be revised in line with CEPT harmonised fixed service recommendations or other relevant applicable harmonisation measures for radio links.

### 5.2.4 Business radio service (including PPDR and PMSE)

5.41 Business radio remains a popular communication system for applications where most traffic is between a control point and one or more mobile terminals, or where groups of mobile terminals need to communicate on a “one to all” basis. The main uses of business radio are for public safety and security (e.g. fire and ambulance emergency services), public utilities, industrial and commercial users (taxis, couriers, security etc.) as well as various voluntary organisations, all of whom need reliable means of communicating with personnel and, in particular, those on the move.

5.42 In the context of spectrum management, “business radio” is a generic term that involves a variety of licence types issued by ComReg across a range of frequency bands. These include licences[95] for:

[94] http://rspg-spectrum.eu/wp-content/uploads/2013/05/RSPG15-607-Final_Report-Wireless_backhaul.pdf (June 2015)

[95] In addition to Licences, permits for Paging (Local Area) are issued (ComReg Document 02/12R).

- Business Radio (ComReg Document 00/07aR1);
- Community Repeaters (ComReg Document 02/03R);
- Mobile Radio Systems (Local Area) (ComReg Document 07/57);
- Third Party Business Radio Licences (ComReg Document 05/82R3);
- Telemetry System (ComReg Document 14/56); and
- Wireless Public Address Systems (ComReg Document 06/26);

5.43 In Ireland, the number of business radio licences has declined significantly (circa 60%) in the past six years. This decline could be attributed to a number of external factors such as the downturn in the construction industry and the increasing use of mobile wireless broadband services instead of business radio services. While such substitution might continue and therefore further decrease demand, ComReg observes that the demand for business radio services is likely to continue into the future given that some critical services often require more resilient services with a higher quality of service than provided with public mobile networks.

### Public Protection and Disaster Relief (PPDR) service

5.44 In relation to public safety services (also known as PPDR services), ComReg issued an Emergency Services Digital Radio Licence to Tetra Ireland in 2008 (see ComReg Document 08/67). This licence allows narrowband frequency digital trunked or direct modes of operation.

5.45 The requirements of the next generation of communications technologies for PPDR is currently being considered at a European level and more broadly. In particular, the PPDR community is seeking access to wideband and broadband services (such as video), and has specific requirements in terms of priority, availability or security.

5.46 ComReg observes that CEPT has identified the spectrum considerations of PPDR as one of its major topics for the next five years and various solutions to meet such requirements are currently being studied by it. In particular, broadband PPDR in the 400 and 700 MHz bands[96] is under active consideration by CEPT[97] and agenda item 1.3 at the WRC-15 is also considering this issue.

[96] Options being considered are at 400 MHz (410 – 430 MHz and 450 – 470 MHz) and at 700 MHz (694-791 MHz) with various configuration options within the duplex gap.

[97] See CEPT Report 218 on “Harmonised conditions and spectrum bands for the implementation of future European broadband PPDR systems”

### Programme Making and Special Events (PMSE) services

5.47 PMSE services encompasses a range of wireless services, such as wireless cameras and microphones used in the production of multi-media content or the staging of live events, and they support diverse activities including news gathering, sports events and outside broadcasts, live concerts, theatre and other events.

5.48 A wide variety of spectrum bands are currently made available in Ireland for PMSE use under the Temporary Business Radio licensing scheme (ComReg Document 08/08R4) [98].

5.49 Some of the bands currently available to PMSE are now being harmonised for other uses (e.g. the CEPT decision on the 2.3 GHz band), while other bands are in the process of being harmonised (e.g. the 700 MHz band). This may lead to a reduction in the available spectrum for PMSE and require alternative bands to be identified.

5.50 At a European level, CEPT has identified the spectrum considerations of PMSE as another of its major topics for the next five years and it aims to designate the necessary spectrum for PMSE, taking into account relevant considerations including the ability to implement digital technology and cognitive sharing solutions, as well as the need to maintain existing production quality.

5.51 To date, Ireland has not experienced a shortage in available spectrum for PMSE. However, given its changing spectrum environment, the spectrum demands of PMSE may need further consideration over the coming years, including the implementation of any future PMSE-related harmonisation measures.

## 5.2.5 Short range devices (including “Internet of Things”)

5.52 Among the most prevalent radio systems in Ireland are short range devices (SRDs).[99] SRDs occupy a range of diverse frequencies in the radio spectrum, ranging from very low frequencies (kHz) to extra high frequencies (GHz). Due to their low power and localised usage, SRDs are generally regarded as having a low capability of causing interference. Consequently, SRDs have generally been

[98] ComReg Document 08/08R4 Radio Licensing for Special Events and Temporary Use in Ireland.

[99] SRDs can be uni-directional and bi-directional low power radio transmitters, and can serve a multitude of purposes. For example, car door openers, baby alarms, wireless microphones and wireless local area networks (WLANs). SRDs are deployed in both private and commercial scenarios. Private applications range from medical implants to cordless telephones. Commercial applications include public access wireless hotspots and RFIDs used in logistics and inventory control. Additionally, SRDs are used for specialised applications such as Road Traffic and Transport Telematics (RTTT) for the management of roads and traffic (such as automatic road toll collection and traffic information).

made exempt from the need for individual radio licences subject to certain technical constraints.

5.53 The common position on spectrum allocations for SRDs within CEPT is outlined in ERC Recommendation 70-03 (ERC/REC/70-03) available from the ECO website (www.cept.org/eco). This recommendation contains the most widely accepted European position with respect to SRDs and provides a useful reference document for Member States.

5.54 In Ireland, the technical criteria for the operation of SRDs on a licence-exempted basis is set out in ComReg document 02/71R[100]. ComReg notes that all SRDs placed on the Irish market are required to comply with the R&TTE Directive[101].

5.55 In Europe, the radio spectrum requirements for SRDs are considered by the CEPT SRD management group. Some of the recent harmonisation studies conducted by this group include the:

- use of the band 870-876 MHz and 915-921 MHz to support applications such as smart meters and smart grids[102];
- use of the 76 to 79 GHz band to support anti-collision helicopter applications; and
- possible extension of frequencies for Wi-Fi using 5 GHz radio spectrum[103].

5.56 The outcome of these considerations may lead to an updating of the harmonisation measures of CEPT and the EC. In Ireland, ComReg implements such harmonisation measures through the maintenance of ComReg Document 02/71R.

### Internet of Things (IoT)

5.57 It is widely predicted that the deployment of the IoT, including machine-to-machine communication (M2M) and Intelligent Transport Systems (ITS), will increase over time (see Figure 10 below) and that this will impact economic growth and social development.

[100] ComReg 02/71R9 – "Permitted Short Range Devices in Ireland" – last revision published March 2014.

[101] The Radio and Telecommunications Terminal Equipment Directive, for which further information may be obtained at: http://ec.europa.eu/enterprise/sectors/rtte/index_en.htm

[102] See ECC Report 189 (February 2014).

[103] See CEPT Report 57.

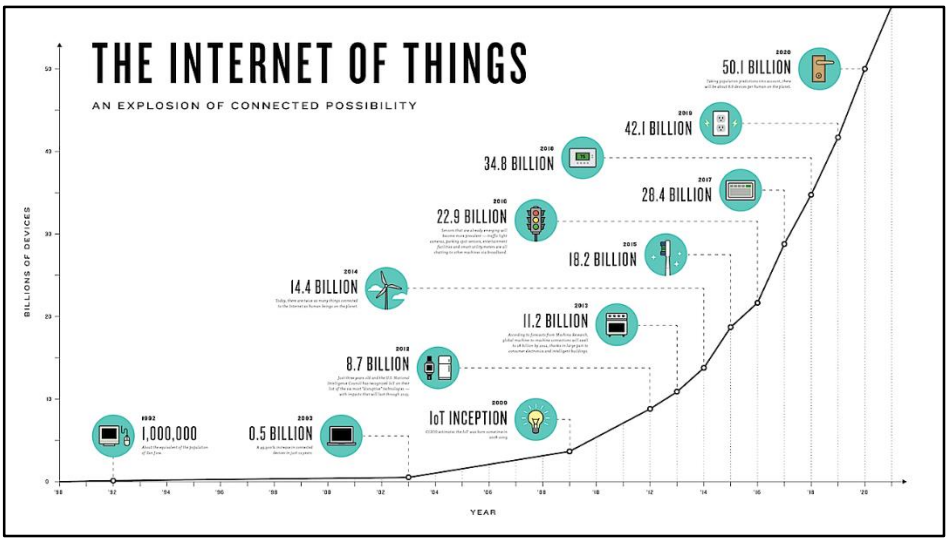


**Figure 10: Infographic on growth in IoT from based on Cisco data by Connectivist[104]**

5.58 The RSPG and CEPT have both identified the spectrum management consideration of IoT as a key item for their respective work plans. CEPT notes that the spectrum requirements of IoT services for SRD[105] remains unpredictable and that it will have to be carefully monitored to ensure regulations accommodate such developments appropriately. In a similar manner, the RSPG observes the need to strategically review the current status of IoT with the aim of developing a strategy for its requirements.

### 5.2.6 Satellite

5.59 Satellite networks provide a variety of applications including:

- mobile and fixed telecommunications (satellite phones and intercontinental telecommunications links);
- broadcasting services, such as Direct to Home (DTH) multichannel television and Satellite Digital Radio (SDR);
- satellite broadband;
- Satellite News Gathering (SNG);

[104] http://www.i-scoop.eu/internet-of-things

[105] Aside from radio frequencies used by SRDs, ComReg notes that radio frequencies used by other existing radiocommunication services (such as the mobile service) can also carry IoT or M2M information/data services.

- meteorological services;
- space research; and Earth Exploration Service (EES) applications.

5.60 Additionally, satellite networks play a crucial role in aeronautical and maritime safety by enabling the provision of services such as the detection of Emergency Position Indicating Radio Beacons (EPIRB), radio navigation services and Global Positioning System (GPS).

5.61 Various spectrum bands have been made available (on both a licence-exempt and licensed basis) for satellite services in Ireland. ComReg Document 00/64R2 sets outs ComReg's guidelines for satellite earth station (SES) licences operating in spectrum above 3 GHz.

5.62 At a European level, ComReg notes that in May 2009 Inmarsat Ventures Limited and Solaris Mobile Limited were selected by the EC[106] as the operators to provide a mobile satellite service (MSS) with complementary ground component (CGC) service on a pan-European level in the band 1980-2010 / 2170-2200 MHz. ComReg observes, however, that more than 6 years later no services have been launched.

5.63 Given the nature of satellite services, the international harmonisation process plays a significant role in shaping the demand for and supply of radio spectrum for same. In that regard, ComReg notes that several satellite-related agenda items across a number of spectrum bands have recently been concluded on at the WRC-15 under agenda items 1.5, 1.6, 1.7, 1.9 and 1.10.

### 5.2.7 Radio Amateur

5.64 ComReg's amateur station licensing scheme allows individuals to use radio equipment for the purposes of conducting experiments, intercommunication and engaging in self-training in wireless telegraphy. The Amateur Service[107] is specifically recognised by the ITU as a service for the purpose of self-training and technical investigations and has specific spectrum allocated to it within the International Table of Frequency Allocations.

5.65 A variety of radio spectrum bands have been made available to radio amateurs, as set out in ComReg Document 09/45R1.

5.66 At WRC-15, under agenda item 1.4, a new secondary allocation was made to the amateur service in the band 5 351.5 – 5 366.5 kHz. ComReg will now

[106] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:149:0065:0068:EN:PDF

[107] Within this document reference to Amateur Service should, unless indicated otherwise be regarded as including the Amateur Satellite Service.

consider if and when it is feasible to release this band in Ireland and if released what usage conditions should apply.

### 5.2.8 Aeronautical, defence, maritime and scientific services

5.67 The safety and efficiency of air transport is dependent on navigation and communication services that use the radio spectrum. Since the bulk of air travel is international in nature, most of the radio spectrum used by the aeronautical sector is planned internationally. In Ireland, regulation of the aviation industry is the responsibility of the Irish Aviation Authority (IAA). ComReg's role in this sector is limited to administering the issue of radio licences for equipment on-board aircraft and ground-based aeronautical transceivers, radar and radio-navigation systems.

5.68 The maritime sector is another significant spectrum user, comprising a large leisure component, an extensive fishing industry, a commercial sector and a wide ranging naval presence. Due to the global nature of maritime services, the management of the radio spectrum for same is largely governed by national and international regulations, such as those relating to safety of life at sea (SOLAS). ComReg's role in this sector is limited to the spectrum management of maritime radio frequencies for apparatus not located on-board vessels. The Maritime Radio Affairs Unit (MRAU) of the Department of Transport is responsible for maritime spectrum management matters on-board vessels.

5.69 Radio spectrum is also used for a wide range of applications that provide significant social and economic benefits operating under the generic description of 'science services'. These include radio astronomy, meteorological satellite and meteorological aids, earth exploration-satellite services (EESS), space research and space operation services.

5.70 In relation to the above services:

- ComReg Document 09/44R3 sets out its guidelines on aircraft station licensing; and
- ComReg Document 11/07 sets out its guidelines on radio-determination, air traffic and maritime service licensing.

5.71 The Defence Forces have actively utilised radiocommunication from the earliest days and their use of radio spectrum is critical to national security. There are no specific service allocations for defence applications in the International Radio Regulations as defence communications are recognised as the prerogative of each sovereign nation. In accordance with the Wireless Telegraphy Act 1926, apparatus for wireless telegraphy kept by or in the possession of the Minister for Defence for the purpose of the Defence Forces do not require a licence.

5.72 Given the nature of the above services, ComReg observes that the international harmonisation processes plays a significant role in determining the demand for and supply of spectrum for these services. Following WRC-15 and the completion of several agenda items involving spectrum matters relating to these services, ComReg will implement changes to the National Table of Frequency Allocations and address any changes that may affect licensee's use of this spectrum.

Chapter 6

# 6 Radio spectrum work plan for 2016 to 2018

6.1 In light of the matters discussed in the preceding chapters, this chapter sets ComReg's proposed radio spectrum work plan for the period 2016 to 2018 having regard to its envisaged spectrum workload and the need for appropriate prioritisation of spectrum activities.

6.2 ComReg has also identified licences that are due to expire over the next six years (i.e. up to 2021) [108] and welcomes the views of interested parties on same in the context of its proposed work plan.

## 6.1 Background

6.3 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 (e.g. resourcing) it may not be possible to carry out all of these actions at the same time.

6.4 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 set to expire within the near future [109] (e.g. within the next 3 years), ComReg endeavours to set out its proposals on the future use such bands

[108] A band-by-band consideration of ComReg's spectrum workload is set out in Annex 3 of this document.

[109] For example, MMDS licences in the 2.6 GHz band expire on 18 April 2016 and FWALA licences in the 3.6 GHz band expire on 31 July 2017. ComReg's current proposals are set out in Documents 14/101 and 15/70.

well in advance of expiry including, where appropriate, defining and carrying-out an assignment process for the radio spectrum;

- the potential for additional spectrum bands to be released - given developments such as the harmonisation of a spectrum band[110] or the potential for re-farming a spectrum band[111], it may be appropriate to consider the release of additional spectrum bands; and
- other developments - this relates to a wide range of external developments including national or EU legislation/policy developments[112], sector-specific or licensee requests[113] etc.

### 6.1.1 Appropriate prioritisation of spectrum work activities

6.5 Given the above, 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. 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 could 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;

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

[111] For example, the 700 MHz band (694-790 MHz) is currently being considered as a spectrum band that could be re-farmed from its current use for DTT to other uses including terrestrial systems capable of providing electronic communications services. A Cost Benefit Analysis (CBA) on the 700 MHz was completed in June 2015 (see Documents 15/62, 15/62a and 15/62b), the results of which indicate that the 700 MHz band should be repurposed as this represents its most efficient use

[112] 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.

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

- 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 defined actions with a set timeframe;
- the adoption of national priorities[114] supported by legislation or similar instruments; and
- the potential for market mechanisms to address spectrum management issues.

6.6 The extent to which any of these factors affect ComReg's prioritisation is considered on a case by case basis. However, certain activities are likely to provide greater benefits than other activities. In particular ComReg observes that:

- the spectrum bands that are subject to harmonisation measures 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 award process for single bands.

6.7 The above considerations have informed ComReg's draft work plan for the period 2016-2018 which is set out below. ComReg welcomes the views of interested parties on this proposed work plan including any suggested modified actions or omissions from it.

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

[114] 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

## 6.2 ComReg's draft work plan 2016 to 2018

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

6.10 ComReg observes that these proposed work plan items below align with its key priorities for radio spectrum as set out in its strategy statement on Electronic Communications (Document 14/75), specifically:

- finalise a strategy for the UHF band (470 to 790 MHz);
- release additional spectrum for wireless broadband; and
- Test & Trial Ireland - promote Ireland's research and development agenda.

### 6.2.1 ComReg's spectrum management function

6.11 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.

6.12 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 licensee's 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 to putting in place new licence regimes or to open 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).

6.13 In relation to the last item, ComReg observes that WRC15 and the EC's Digital Single Market proposals are two spectrum management 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 work plan over the 2016 to 2018 period.

### 6.2.2 Mobile, nomadic and fixed wireless broadband services

6.14 ComReg has identified the following work plan items[115] 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[116];

iv. Continue ComReg's consultation process on liberalising the paired 2 GHz band;

v. Set out a regulatory framework for the leasing of spectrum rights in the RSPP bands in advance of 31 July 2017[117];

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

[116] On 30 November 2015, Vodafone wrote to ComReg outlining its views on spectrum strategy (a non-confidential version of which is contained in Annex 4). In light of the nature of the matters raised by Vodafone, ComReg is treating this letter as an input to this consultation process, to be considered alongside submissions received from interested parties (non-confidential versions of which will also be published in accordance with ComReg Document 05/24)..

[117] In that regard, ComReg would appreciate any preliminary views interested parties may have on high level issues concerning the appropriate approach to such a framework including, in particular:

- whether the notification obligation in respect of transfers arising under Regulation 19(4) of the Framework Regulations should also apply in respect of proposed spectrum leases (noting that, in any event, actions by ComReg would be required to give effect to any proposed spectrum lease, for example modification of the leasing parties' respective spectrum licences and/or the issue of an appropriate authorisation to a leasing party who does not hold a WT licence etc;

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 spectrum divestment commitment 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. Publish non-confidential information relating to the results of ComReg's drive-testing programme of mobile networks in Ireland; and

xi. Facilitate better understanding of the factors impacting on actual mobile consumer experience and take appropriate measures on foot of same.

6.15 In relation to the above, ComReg observes that:

- the envisaged next step in relation to the 3.6 GHz band is the issue of a response to consultation and draft decision in Q4 2015;
- the results of the cost benefit analysis on the 700 MHz band[118] indicate that the 700 MHz band should be repurposed as this represents it most efficient use. Preparations are ongoing to facilitate a repurposing of the 700 MHz band in the future, and key items to progress this matter include finalising an internationally coordinated spectrum plan for DTT below 700 MHz (see broadcasting section below), and any announcements on the approach to the repurposing and a switchover date[119];

- whether the approach and terms of the existing framework for spectrum transfers would generally be sufficient to address the substantive (i.e potential competition) and practical/implementation issues involved with a lease of spectrum rights in the RSPP bands (subject to suitable modification/s);
- what measures would be appropriate to ensure that potential transfer/leasing parties do not have incentives to "game" the respective review processes. For example, proposing a lease for effectively the entire duration of the right of use in question with a view to minimising regulatory scrutiny (including scrutiny by interested parties not party to the proposed lease); and
- any other specific issues (substantive and/or procedural) involved with potential spectrum leases that should be taken into account when designing the appropriate framework for spectrum leasing in the RSPP bands.

[118] Documents 15/62, 15/62a and 15/62b

[119] In the switchover from analogue to digital terrestrial television in 2012 the minister for CENR announced the analogue switch-off (ASO) date in 2010, and an all-island approach was successfully used.

- noting the considerable work required in relation to the 3.6 GHz band, 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 second half of 2016 onwards. ComReg notes that there are various spectrum band options available, including the holding of award process for multiple bands, the holding of an award process 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;
- while a response to Consultation 14/65 on the 2 GHz band remains a work plan action, its timing needs to be considered in light of other work programme priorities and the likely timing of the existing licensee's need for liberalisation in this band;
- as discussed in Annex 3 and SRDs below, ComReg:
    - intends to designated and make available the 870-876/915-922 MHz band for SRDs shortly after the expiry of the WDMDS licence using 900 MHz radio spectrum in December 2015 (i.e. the licence currently held by Digiweb); and
    - is of the view that it should take no specific action(s) following the expiry the WDMDS licence using 400 MHz radio spectrum in 2015 (i.e. the licence currently held by Wirefree Communications). In this regard ComReg notes that this spectrum band forms part of the BB-PPDR harmonisation spectrum considerations;
- as discussed in Annex 3, ComReg is of the view that developments in the 10 to 10.145 GHz band do not warrant any action at this time.

### 6.2.3 Broadcasting services

6.16 ComReg has identified the following 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 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 plan 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.

6.17 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 same by Q2 2016; and
- the broadcasting licences for DTT, LW, FM and DAB licences all expire in 2019 and a review of the spectrum management considerations and licence conditions significantly in advance of licence expiry is appropriate.

### 6.2.4 Point-to-Point Radio Links

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

i. Consider the use of national block licensing in the 26 GHz band in advance of its 2018 licence expiry and if warranted establish 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);

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;

iv. Review congestion issues associated with the licensing of fixed links to ascertain if the current congestion areas and frequency bands remain congested and if there are any other areas and frequency bands that have or are reasonably likely to become congested;

v. Consider appropriate changes to radio links licensing aspects to address relevant spectrum management issues (e.g. congestion).

6.19 In relation to above, ComReg observes that:

- the national block licences in 26 GHz band expire in June 2018. ComReg envisages that further information would be provided on same in early 2017;
- 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 objectives; and

- amendments to the current radio links legislation may be appropriate as a means of updating the licence fee to today's prices and managing congestion issues, etc.

### 6.2.5 Satellite

6.1 ComReg has identified the following 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 on a case-by-case basis the appropriate means of authorising SES below 3 GHz; and

ii. Monitor developments in relation to MSS noting that the consideration of CGC issue is contingent upon successful satellite launch by operators and other matters including compliance with rollout and coverage obligations as determined by the EC award.

### 6.2.6 Short range devices (including IoT)

6.2 ComReg has identified the following work plan items concerning 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. Intends to designate and make available the use of the bands 870-876 / 915 - 921 MHz for SRDs (see ECC Report 189) shortly after the expiry of the WDMDS licence using 900 MHz radio spectrum in December 2015 (i.e. the licence currently held by Digiweb);

iii. Consider supporting the 76 to 79 GHz radio band for SRDs (to support anti-collision helicopter applications); and

iv. Monitor, contribute to and promote Ireland's spectrum management position in relation to IoT.

### 6.2.7 Aeronautical, maritime, scientific and defence

6.3 ComReg has identified the following 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)

6.1 ComReg has identified the following 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 PMSE and take appropriate actions to implement harmonisation decisions; and

iv. Monitor and contribute to the spectrum management considerations in respect of broadband PPDR.

### 6.2.9 Radio Amateur services

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

i. Consider a possible new allocation to the amateur service on a secondary basis in the band 5 351.5-5 366.5 kHz in line with the outcome of agenda item 1.4 of WRC15; and

ii. Consider additional spectrum allocations to the amateur services in the bands 30 – 49 MHz and 52 – 70.5 MHz to facilitate propagation beacons, digital amateur television repeaters and to align current allocations with those in the European Common Allocation Table.

Chapter 7

# 7 Topical spectrum management issues

7.1 In this chapter, ComReg outlines its current thinking on a number of topical spectrum management issues. 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 draft spectrum work plan for 2016 to 2018 relate to ECS; and
- its management of radio frequencies for ECS entails various objectives and duties set out in the Common Regulatory Framework (and primarily in the Framework and Authorisation Regulations).

7.2 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, mobile retail consumer experience issues, technology and service neutrality and transparency of information).

7.3 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 in 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) etc.; and
- other relevant developments, including international developments and relevant observations as discussed earlier in this document.

## 7.1 The use of auctions for awarding spectrum rights of use for ECS

### ComReg's position as set out in Documents 11/89 and 11/88

7.4 In Documents 11/89 and 11/88, ComReg set out its then current position on the use of auctions for assigning spectrum rights of use for ECS. In summary and among other things, ComReg stated that:

- it does not favour any specific approach for awarding spectrum rights of use but prefers to consider each award on its own merits;
- in recent years, it has found it beneficial to use auctions as an award mechanism for certain bands where the number of licences to be awarded was limited and it seemed to it that demand could exceed supply[120];
- auctions have proven to be a quick, fair and transparent method for assigning spectrum rights, and appropriate in both 'greenfield' (i.e. where no existing rights used for ECS are involved – e.g. 800 MHz) and 'brownfield' settings (e.g. where existing rights for ECS are involved – 900 MHz and 1800 MHz);
- auctions can provide the necessary flexibility to address situations where there are issues relating to continuity of supply or potential disruption to existing consumer services (through potential loss of access to existing spectrum rights).[121]

[120] In section 4.2.1 of ComReg Document 11/28, ComReg noted that:

- a single sealed bid auction format was used in 2005 for the issue of three 10-year national licences (two in the 400 MHz band and one in the 900 MHz band) for the provision of Wideband Digital Mobile Data Services;
- a single sealed bid, second price format, was used in 2007 for the issue of a national licence for the 1785 - 1805 MHz band;
- a sealed-bid, combinatorial auction was used in 2008 to issue spectrum rights for national point-to-point and point-to-multipoint services in the 26 GHz band for a ten year period.
- a Combinatorial Clock Auction (CCA) was proposed for the 800 MHz, 900 MHz and 1800 MHz spectrum release.

[121] For instance, ComReg observed that an auction with open rounds can allow firms to better check their valuations on business continuity and to update this in light of the information generated in an auction. Such a mechanism may also provide benefits to all participants where there may be significant common value uncertainty regarding the appropriate pricing of particular spectrum rights.

7.5 ComReg also made the following observations regarding increased use of auctions to assign spectrum rights for ECS[122]:

- A reason which may explain why auctions have proven (in Ireland and abroad) to be a fast, fair, effective and transparent assignment mechanism is that they avoid the subjectivity involved in comparative selection procedures (e.g. "beauty contests"), and facilitate market-based resolution of award outcomes, especially where the spectrum manager does not have access to complete information;
- auctions also allow firms which most value the spectrum rights to obtain access to same. By doing so, auctions promote innovation and investment in new infrastructures and contribute to the efficient use of the spectrum rights assigned by providing real economic incentives for winners to make use of the spectrum rights obtained. This also ensures that consumers and end users derive the maximum benefit in terms of the provision of end-services using that spectrum; and
- auctions also promote, among other things, regulatory certainty, competition (both for the spectrum rights and in the downstream provision of services to consumers and end users), and the internal market by ensuring there is no favourable treatment of particular undertakings thereby providing fair opportunities for new entry from within the State and throughout the EU.

### Relevant Irish developments since 2011

7.6 Since 2011, ComReg has used, or proposed the use of, auctions as a means by which to appropriately assign spectrum rights for ECS.

7.7 As noted in Chapter 3, ComReg successfully completed its MBSA process in 2012 for the award of spectrum rights in the 800 MHz, 900 MHz and 1800 MHz bands[123]. The award process comprised of a number of stages, including an application stage, a qualification stage, a main stage and an assignment stage[124]. As demand exceeded supply in the main stage of the MBSA process a

[122] Particularly in circumstances where, for instance, spectrum rights of are likely to be scarce, there is likely to be considerable demand for particular spectrum rights and/or where access to particular spectrum rights is important to the nature and dynamic of downstream (i.e. retail) competition.

[123] ComReg Document 12/123, Information Notice - Results of the Multi-Band Spectrum Auction, 15 November 2012.

[124] The assignment round auction permitted ComReg to resolve the issue of winners' location in the relevant bands without the need for administrative decision-making particularly in circumstances where it was faced with imperfect information and idiosyncratic values of different winners.

Combinatorial Clock Auction (CCA) was held and this determined who won what amount of spectrum rights.

7.8 In determining the ideal auction format to be used in the MBSA, ComReg observed that the CCA format would be more appropriate than the Simultaneous Multiple-Round Ascending (SMRA) format because, among other things, the CCA format:

- allowed for bidders to bid on a package of spectrum rights in these bands, thereby minimising the risk of winners being assigned a package that it did not want (i.e. it better minimised the aggregation risks faced by bidders);
- mitigated common value uncertainty and addressed business continuity risks; and
- better reduced the ability of bidders to use gaming strategies and/or tacitly collude, by minimising transparency during the auction to only what was necessary.

7.9 In 2014, ComReg proposed the use of an auction (with a CCA format) in its proposed award of rights in the 2.6 GHz band and other potential bands potentially including the 700 MHz, 1.4 GHz, 2.3 GHz and 3.6 GHz bands (Document 14/101) because of, among other things, similar issues (i.e. aggregation risks) that could be faced by bidders in such an award of rights in multiple spectrum bands. [125]

7.10 More recently, ComReg proposed the use of CCA in its proposed award of rights in the 3.6 GHz band, again noting the aggregation risks that could be faced by bidders arising from the proposed regional licensing approach. [126]

### Relevant international developments

7.11 The recently published RSPG draft report for consultation entitled on efficient awards and efficient use of spectrum (the "RSPG Efficient Awards Report")[127] considers, among other things, the experiences of awards across Europe over the last 20 years. In that regard, the RSPG observes that auctions are not the only option and that they sit alongside other processes for awarding spectrum such as beauty contests or hybrid approaches. The RSPG further observe that

[125] See section 5.2 of Document 14/101, "Spectrum Award- 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", 30 September 2014

[126] See section 5.2 of Document 15/70, "Consultation on Proposed 3.6 GHz Band Spectrum Award", 10 July 2015

[127] http://rspg-spectrum.eu/wp-content/uploads/2013/11/RSPG15-619-Draft_report-Efficient_Awards_Use_of_Spectrum_PC.pdf published 21 October 2015

that, since 2000, auctions have been widely used in Europe to assign spectrum rights of use for ECN/ECS and that auctions are an important tool in the regulatory toolkit for ensuring the efficient use of spectrum.

7.12 In considering the various auction formats available, the RSPG noted that the most commonly used auction formats used in Europe in the last eight years have been the SMRA, the CCA and the sealed bid auction as outlined in Table 1 and Table 2 below.

**Table 1: Multi-band awards in Europe (Table 2 of RSPG Efficient Awards Report)**

| Country | Year | Format | Bands | | | | |
|---|---|---|---|---|---|---|---|
| | | | 800 MHz | 900 MHz | 1800 MHz | 2.1 GHz | 2.6 GHz |
| Germany | 2010 | SMRA | ✓ | ✓ | ✓ | | ✓ |
| Italy | 2011 | SMRA | ✓ | | ✓ | ✓ | ✓ |
| Spain | 2011 | SMRA | ✓ | ✓ | | | ✓ |
| Spain | 2011 | SMRA | | ✓ | | | ✓ |
| Portugal | 2011 | SMRA | ✓ | ✓ | ✓ | ✓ | ✓ |
| Greece | 2011 | SMRA | | ✓ | ✓ | | |
| Romania | 2012 | Clock | ✓ | ✓ | ✓ | | ✓ |
| Netherlands | 2012 | CCA | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ireland | 2012 | CCA | ✓ | ✓ | ✓ | | |
| Czech Republic | 2013 | SMRA | ✓ | | ✓ | | ✓ |
| Austria | 2013 | CCA | ✓ | ✓ | ✓ | | |
| Slovakia | 2013 | CCA | ✓ | | ✓ | | ✓ |
| United Kingdom | 2013 | CCA | ✓ | | | | ✓ |
| Norway | 2013 | 1PSB[26] | ✓ | ✓ | ✓ | | |
| Slovenia | 2014 | CCA | ✓ | ✓ | ✓ | ✓ | ✓ |

**Table 2: Single band awards (Table 3 of RSPG Efficient Awards Report)**

| Country | Year | Format | Bands | | | | |
|---|---|---|---|---|---|---|---|
| | | | 800 MHz | 900 MHz | 1800 MHz | 2.1 GHz | 2.6 GHz |
| Sweden | 2008 | SMRA | | | | | ✓ |
| Finland | 2009 | SMRA | | | | | ✓ |
| Austria | 2010 | CCA | | | | | ✓ |
| Denmark | 2010 | CCA | | | | | ✓ |
| Netherlands | 2010 | CCA | | | | | ✓ |
| France [27] | 2011 | Sealed Bid single round / sequential | ✓ | | | | ✓ |
| Sweden | 2011 | SMRA | ✓ | | | | |
| Sweden | 2011 | Clock | | | ✓ | | |
| Denmark | 2012 | CCA | ✓ | | | | |
| Norway | 2012 | Clock | | | | ✓ | |
| Finland | 2013 | SMRA | ✓ | | | | |

7.13 In relation to some of the more recent spectrum awards, ComReg observes that:

- Germany recently awarded spectrum rights in the 700, 900, 1500 and 1800 MHz radio bands using an SMRA auction;[128]
- France completed its award of rights of use in the 700 MHz radio band via auction in Q4 2015[129]; and
- a number of auctions concerning various radio bands, including the 1.4, 2.3, 2.6 and 3.6 GHz bands, were conducted in Italy[130], Turkey[131], India[132] and UK[133].

### ComReg's current thinking

7.14 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;

[128] http://www.policytracker.com/headlines/german-multiband-auction-concludes-at-20ac5.1-billion

[129] http://www.arcep.fr/index.php?id=8571&tx_gsactualite_pi1%5buid%5d=1780&tx_gsactualite_pi1%5bannee%5d=&tx_gsactualite_pi1%5btheme%5d=&tx_gsactualite_pi1%5bmotscle%5d=&tx_gsactualite_pi1%5bbackID%5d=26&cHash=cf17f20f53fd8f3d1f9a3334c1ffe04d&L=1 and http://www.arcep.fr/index.php?id=8571&tx_gsactualite_pi1%5Buid%5D=1804&tx_gsactualite_pi1%5Bannee%5D=&tx_gsactualite_pi1%5Btheme%5D=&tx_gsactualite_pi1%5Bmotscle%5D=&tx_gsactualite_pi1%5BbackID%5D=26&cHash=f201c02515cd734eff10550f0436cf10&L=1

[130] http://www.policytracker.com/headlines/italy-sells-40-mhz-in-l-band-for-20ac462-million

[131] http://www.policytracker.com/headlines/turkish-auction-garners-3.36-billion-euros

[132] http://www.policytracker.com/headlines/india-plans-to-assign-700-mhz-band-in-multiband-auction

[133] http://www.policytracker.com/headlines/uk-public-sector-spectrum-release-could-be-staggered-to-protect-competition

- 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 regarding auctions in Documents 11/89 and 11/88) and further observes that both Irish and international spectrum management experience would support the continued appropriate use of auctions generally;
- observes that there are different auctions formats available and that the most appropriate format will, of course, be the one which best addresses the specific 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, and can significantly mitigate against a number of award risks including gaming and common value uncertainty. It also 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;
    - 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 aggregation risks are not a material issue; and
    - sealed bid combinatorial auctions have been used both here[134] and internationally, and could be an effective auction format, particularly in circumstances where the common value uncertainty is likely to be low and competition for spectrum is likely to be weak

## 7.2 Spectrum trading/transfers

### ComReg's position in Documents 11/89 and 11/88

7.15 In Documents 11/89 and 11/88, ComReg set out its then current thinking on the transfer of spectrum rights between undertakings (i.e. secondary trading). In summary and among other things, ComReg stated that:

[134] 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.

- it sees spectrum trading as an important right that spectrum rights holders should have and could lead to market-based exchanges that increase the welfare not just of the parties to the trade but society generally;
- it did not consider that indefinite licence durations were required to substantially realise the potential benefits of spectrum trading; and
- it intended to specify a secondary trading regime for the bands identified by the European Commission under Article 9(3) of the Framework Directive, as subsequently specified in the EU RSPP Decision[135] of 2012.

### Relevant Irish Developments since 2011

7.16 In 2014, ComReg introduced its framework (procedures and guidelines) for the transfer of spectrum rights in the bands identified in the RSPP Decision (see Document 14/11 and the spectrum transfer regulations[136]).

7.17 In finalising its framework for spectrum transfers, ComReg noted that it was necessary to return to the matter of whether or not a separate regime for spectrum leasing was necessary after the framework for transfers had been established and with the benefit of ComReg's experience in managing and administrating such a regime.

7.18 To-date, no spectrum transfers have been notified to ComReg in accordance with this framework[137].

### Relevant European Developments

7.19 The trading and leasing of spectrum rights in Europe was considered in the RSPG Efficient Awards Report. In that regard, the RSPG observed that the majority of spectrum trades in the harmonised bands Europe occurred where regional/local regional authorisations are in force (for example 3.5GHz regional licence in France) or in the case of a merger between mobile operators. In relation to the latter, the RSPG observed that this is likely to be subject to the analysis of the NRA and competition authorities.

7.20 The RSPG also stated that the take-up of trading of spectrum usage rights across Europe has been mixed, with many countries only experiencing limited trades

[135] Decision 2012/243/EU of the European Parliament and the Council concerning Radio Spectrum Policy Programme (RSPP).

[136] The Wireless Telegraphy (Transfer of Spectrum Rights of Use) Regulations 2014 (S.I. No. 34 of 2014).

[137] The framework did not apply to the acquisition of Telefónica by Hutchison as the framework does not apply to any transfer that forms part of a merger or acquisition which is required to be notified to the Competition Authority in accordance with Part 3 of the Competition Acts 2002 to 2012 or to the European Commission in accordance with Council Regulation (EC) No 139/2004.

although a few, such as Sweden, experiencing a significant number of trades in the harmonised bands.[138]

7.21 The RSPG considers that further work may be undertaken to understand reasons for the differing levels of trading of spectrum rights of use of ECS across Member States. The RSPG also noted that even though secondary trading does not represent an objective by itself, it can be a tool that contributes to better spectrum management, alongside other mechanisms that promote the efficient use of spectrum in the harmonised bands.

### ComReg's current thinking

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

7.23 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 regulations[139];
- 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 Authority in accordance with Part 3 of the Competition Acts 2002 to 2012 or to the European Commission in accordance with Council Regulation (EC) No 139/2004; and
- the RSPP Decision and the Common Regulatory Framework for spectrum contemplates leasing of rights of use to radio spectrum.

7.24 In relation to leasing, ComReg's draft spectrum work plan for the period 2016 to 2018 includes an action 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

### ComReg's position in Documents 11/89 and 11/88

[138] See page 43 for examples of trades in the UK, France, Sweden, Austria and Norway.

[139] Document 14/11 and S.I. No. 34 of 2014.

7.25 In the context of spectrum rights for ECS and by way of background, ComReg recalls regulation 9(6) of the Authorisation Regulations, which provides:

> *"Rights of use for radio frequencies shall be in force for such period as the Regulator 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."*

7.26 In ComReg Documents 11/89 and 11/88, ComReg set out its then current thinking on the above issue. In summary and amongst other things, ComReg stated in Document 11/89 that:

- licences of finite duration allow a spectrum manager to seamlessly maintain the co-ordination of the most important bands because they:
    - ensure that Member States can implement any future major allocation and harmonisation changes made by the EC to bands in order to exploit the advantages arising from the internal market and to prevent any significant delays to the deployment of new services which could have serious consequences for consumer welfare; and
    - alleviate ComReg's concerns that indefinite licences (or licences that are automatically renewed) could potentially lead to strategic behaviour whereby one or more firms resist the band/s being co-ordinated in perhaps different manner with a view to obtaining some of the higher rents from a new potential use;
- it considered the arguments regarding the uncertainty associated with periodic re-release of spectrum to be overstated and not to accord with the likely economic incentives of incumbent operators facing such a situation and, in this regard, observed that:
    - reducing investment may actually encourage outside firms to enter on the basis that the incumbent firms appear to believe that their substantial advantages of incumbency are not sufficient to allow them to outbid their likely competitors in an auction;
    - moreover, incumbent firms are competing with each other on the retail market/s and any loss in network quality (arising from non-investment) could translate to worse outcomes on the retail market. Hence, they will be strongly motivated to maintain their network quality or risk losing valuable customers (and customer groups that value network quality highly); and

- with indefinite licences there would not be the same incentive to fear new entry and hence investment rates would likely fall, once a stable market equilibrium emerges[140].

7.27 In section 3.4 of Document 11/88, ComReg set out, in considerable detail, the views of respondents to the previous spectrum strategy consultation on this issue and its analysis of same.

7.28 In that regard, and in relation to suggestions received concerning indefinite licensing inclusive of provisions under which a licence could be revoked (for instance in specific circumstances and/or with a minimum notice period), ComReg recalls its view that such an approach overlooks the uncertainty, delay and potential litigation that could well be associated with a spectrum manager seeking to recover spectrum rights via such measures[141].

7.29 At the same time, ComReg observed that it would not ignore evidence of (subsequent) unexpected developments which may, for instance, warrant consideration of appropriate (e.g. objectively justified, proportionate and non-discriminatory) adjustments to what was previously determined optimal finite durations of particular spectrum rights.

### Relevant Irish Developments since 2011

7.30 Since 2011, and amongst other things, ComReg:

- issued spectrum rights of use in the 800 MHz, 900 MHz and 1800 MHz bands with a maximum licence duration of circa 17.5 years. To accommodate the pattern of the then current licence assignments, spectrum rights of use were issued in two "time slices".[142] All spectrum rights of use in these bands expire on 12 July 2030;

[140] ComReg noted that "*Trading would not undermine this market situation as in the most valuable bands trading (or even leasing) would likely not occur. ComReg is of the view that, absent a distress sale, within a market trading is actually not likely to occur for strategic reasons. Even if a firm has valuable spectrum that it is currently not using intensively it may well choose to maintain this position in order to be able to react to growth in demand etc. that it had not previously predicted. Selling such spectrum to a rival is an irreversible decision that they may come to regret later. Similar concerns also surround leasing to a rival even if there comes a time when the spectrum reverts to the original licence holder.*"

[141] Section 3.4.2 of Document 11/88 referred to such an argument in the context of observations ComReg drew in relation to Ofcom's, the UK spectrum regulator's, then proposed application of spectrum liberalisation and trading to the mobile sector in 2009, and submissions made by UK MNOs on those proposals (see also footnote 22 and 23 therein for information on ComReg's observations on the matter).

[142] Time Slice 1: 1 February 2013 to 12 July 2015; Time Slice 2: 13 July 2015 to 12 July 2030.

- proposed a finite licence duration of somewhere in the range 15 to 20 years for the proposed award of rights in the 2.6 GHz band and potential other bands (see section 4.4.4 of Document 14/101); and
- in Document 15/70, proposed a duration of 15 years for its award of spectrum rights in the 3.6 GHz band (see section 4.4 of same).

7.31 In addition, and so as to facilitate liberalisation as soon as practicable and in advance of the expiry of spectrum rights, ComReg notes that the MBSA process included an early liberalisation option that allowed bidders to liberalise some or all their existing GSM-only spectrum rights in the 900 MHz and 1800 MHz bands. From a regulatory perspective ComReg observes that this measure proved particularly effective, as among other things, it facilitated timely and efficient infrastructure investments, ecosystem permitting, and allowed the licensees to deploy new services to the benefit of users.[143]

### Relevant international developments

7.32 The duration of rights of use in the harmonised spectrum bands for ECS is discussed by the RSPG in its Efficient Awards Report where, among other things, the RSPG considers it essential that a licence term is of sufficient duration, taking into account national circumstances, to provide legal certainty and the promotion of investment.

7.33 In relation to the current practice in Europe, the RSPG notes that most Member States issue licences for a specific duration, usually around 15-20 years. In this regard, the RSPG presented an overview of licence expiry in a number of harmonised bands, as outlined in Figure 11 below.

[143] Both Vodafone and Meteor availed of the early liberalisation option to liberalise some or all of their GSM-only spectrum rights. In the 1800 MHz band, LTE services have been introduced by both Vodafone and Meteor, while in the 900 MHz band 3G services have been introduced by Meteor.

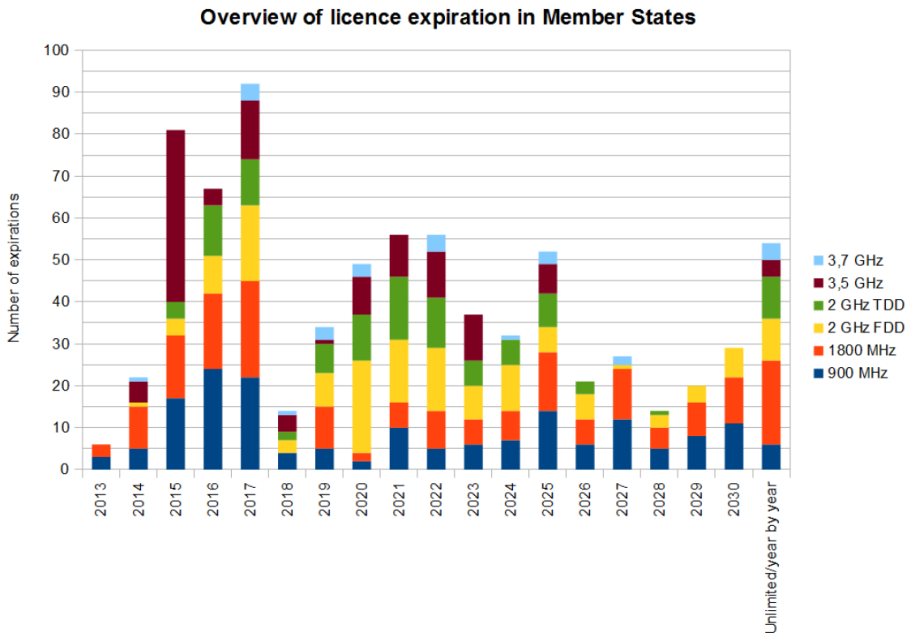


**Figure 11: Overview of licence expiry in a number of harmonised bands for ECN/ECS (Table 4 of RSPG Efficient Awards Report)**

7.34 The RSPG also noted that in a few cases the licence duration is not specified and a revocation notice may be issued after a set period of time.[144] For example, in the UK, Ofcom generally grants indefinite licences with a minimum period of notice for revocation (such as five years) for spectrum management reasons.[145]

7.35 In relation to issuing spectrum rights of an indefinite duration, ComReg observes that such practice can result in considerable spectrum management challenges such as those associated with any recovery of spectrum rights[146] or the setting of revised annual licence fees to reflect market value[147].

### ComReg's current thinking

[144] For further detail, please refer to ECO Report 03 http://www.efis.dk/views2/report03.jsp

[145] In order to give the licensee certainty following the award that it will have at least a minimum period to recover their investment, Ofcom generally offers assurances during the award that no such revocation notice will be issued for a certain period (e.g. not in the first 15 years). In this example the licensee will then have a minimum duration of 20 years (15+5 years), with a 5 year notice period thereafter.

[146] See footnote 23 of Document 11/88 in relation to the UK proposals to rebalance the 900 MHz spectrum band.

[147] On 20 December 2010, the UK Government directed Ofcom to revise the fees for 900 MHz and 1800 MHz spectrum licences to reflect the full market value of those frequencies. Ofcom has been consulting on revising these fees since the conclusion of the 4G auction in February 2013, and in September 2015, it set out it decision. See http://stakeholders.ofcom.org.uk/consultations/annual-licence-fees-further-consultation/statement/

7.36 First, ComReg will, of course, continue to appropriately establish the duration of spectrum rights for ECS in accordance with its statutory objectives 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 (including, 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.

7.37 In that regard, ComReg generally observes that the weight of spectrum management practice in Europe and more broadly for relevant spectrum bands has been, firstly, for spectrum rights of a finite duration and, secondly, for durations of around 15 to 20 years. ComReg would further observe that such durations are broadly similar to those have been adopted by ComReg (such as in its MBSA process) and are currently proposed by ComReg (for instance in Documents 14/101 and 15/70).

7.38 In addition, for the reasons outlined in Document 11/88, ComReg considers the arguments 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.

7.39 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 spectrum rights for these bands have yet to be determined.

7.40 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, amongst 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, could be a useful mechanism to address such circumstances. When ComReg consults on its draft Spectrum Strategy statements, ComReg notes rights of use that are due to expire within the following 5-6 years and includes in its proposed workplan 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 have the opportunity to highlight this (preferably with supporting reasons and evidence) when responding to the consultation.

## 7.4 The sharing of spectrum and collaboration between wireless operators

7.41 This section discusses the following two matters:

- 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

#### Background and relevant Irish developments

7.42 The sharing of spectrum between different services or users can increase the effective and efficient use of spectrum and is commonly used in Ireland and elsewhere. This is particularly the case in relation to licence-exempt SRDs, which often operate on a non-protected non-interference basis in spectrum bands which have licensed user/s. For some spectrum bands harmonised at an EU level, (e.g. the 3.6 GHz band), the harmonisation decision obliges Member States to designate and make available the spectrum band on a non-exclusive basis, and authorisations issued by ComReg for such bands are non-exclusive. For other spectrum bands, and to facilitate this sharing possibility given its

potential benefits, it is ComReg's practice that authorisations (licence exemptions and licences) for these other spectrum bands are also issued on a non-exclusive basis[148].

7.43 Over time the possibility of spectrum sharing may evolve given (i) advances in sharing technologies (e.g. cognitive devices, white space devices etc.) and (ii) advancements in the regulatory framework for sharing (e.g. the "licensed shared access" ("LSA") framework currently being considered within Europe for certain spectrum bands). ComReg notes that these advancements are still relatively immature in terms of their development.

### Relevant international developments

7.44 The draft RSPG Opinion on the implementation of the current RSPP and its revision to address the next period (the "RSPG RSPP Opinion")[149] considers the increasing role of spectrum sharing, and notes that:

- due to a more intensive usage of radio spectrum by various sectors, spectrum policy and national implementation will have to rely more and more on the shared use of bands;
- various spectrum sharing solutions are available such as geographical, temporary sharing, white spaces, geolocation database, etc.; and
- the LSA approach is a possible regulatory solution by which to increase the efficient usage of spectrum at national level. However, the relevant technology to implement this approach is still under development, and various trials are on-going in Member States in the band 2.3-2.4 GHz.

7.45 In relation to spectrum challenges for the next 5 years, amongst other things, the RSPG advises Member States to:

- assess national solutions to implement LSA as a possible voluntary regulatory approach compliant with the current EU legal framework; and
- develop, on a national basis, new forms of sharing and to experiment with them.

### ComReg's current thinking

[148] For example, the Liberalised Use Licences for 800 MHz, 900 MHz and 1800 MHz bands are issued on a non-exclusive basis, while similar proposals are included in ComReg's 3.6 GHz spectrum band award proposal as set out in Document 15/70 (see section 6.2).

[149] http://rspg-spectrum.eu/wp-content/uploads/2013/11/RSPG15-621rev-RSPP_draft_opinion_PC.pdf , published 21 October 2015.

7.46 ComReg's current thinking on spectrum sharing is that:

- it would continue to facilitate the sharing of spectrum between different users/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 that all authorisations (licence exemptions and licences) are issued 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

### ComReg's position in Documents 11/89 and 11/88

7.47 In Documents 11/89 and 11/89, ComReg noted:

- the trend towards increased collaboration between operators in the provision of wireless/mobile service and potential drivers for same;[150] and
- there are many forms of many forms of collaboration with the benefits and drawbacks of each type depending on the specifics of the collaboration.

7.48 ComReg also stated that:

- it expected the licences that it will issue will permit an undertaking to contemplate any form of collaboration that it may wish to consider; and
- given that any examination of a collaboration proposal would occur within the context of ComReg's statutory functions, objectives and duties, interested parties should be in a position to identify for themselves the nature and extent of potential issues/concerns that could be raised by their proposed collaboration.[151]

7.49 Further, and noting that the nature and extent of any potential regulatory issues will depend on the specifics of the proposed collaboration, ComReg observed

[150] These include operators' desire to reduce costs and/or provide a higher quality of service to consumers by using their combined resources.

[151] For example, potential issues and concerns, such as in relation to:

- competition issues arising from proposed collaboration between actual and potential competitors;
- the impact of collaboration proposals on efficient spectrum use and effective spectrum management; and/or
- whether any potential restriction on competition (and other potential draw- backs) would be more than compensated for by the cost savings and other benefits that would be passed on to final consumers.

that it could not have a firm view on spectrum rights sharing (or pooling) other than that it would look more favourably on agreements that would not overly restrict competition and would deliver demonstrable benefits that are shared with final consumers.

### Relevant Irish developments since 2011

7.50 In 2011 and 2012, two collaboration agreements were agreed involving mobile network operators; one between eircom and Telefónica and another between Vodafone and Three.

7.51 Following the acquisition of Telefónica by Hutchison 3G UK Holdings Limited (Hutchison) in 2014, a new collaboration agreement was concluded between eircom and Three, and the Vodafone and Three collaboration arrangement was terminated.

### Relevant international developments

7.52 In its Efficient Awards Report, the RSPG outlined a number of potential benefits and competition issues that may be associated with spectrum or network sharing between MNOs[152]. It also noted a number of recent examples of sharing / pooling in Sweden and Finland[153] and stated that sharing could be considered as part of the award design process depending on the specific policy objectives of the award.

### ComReg's current thinking

7.53 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 remains of the view 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 overly restrict competition and would deliver demonstrable benefits that are shared with final consumers.

[152] See pages 48-52.

[153] In Sweden, TeliaSonera did not win a 3G license but acquired a 50% share of the Tele2-owned licensee SUNAB. Telenor and HI3G formed the jointly owned (50/50%) company 3GIS to roll-out rural 3G coverage. In addition, Tele2 and Telenor formed the jointly owned (50/50%) company Net4Mobility to roll-out a combined GSM/LTE-network.

In Finland, voluntary agreements between license holders in the 3.5GHz frequency band have minimised and in some cases completely removed the mandatory co-ordination distance for frequency re-use between geographically adjacent service areas in the 3.5GHz frequency band.

7.54 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

### ComReg's position in Documents 11/89 and 11/88

7.55 In Document 11/89 and 11/88, ComReg noted, amongst other things, that:

- a key objective of ComReg is to promote and safeguard competition and, in the context of its spectrum management activities, this includes both competition for spectrum rights and downstream/retail competition;
- in a spectrum competition, the nature and level of a spectrum competition cap are important considerations because they can influence the level of demand that may be expressed for spectrum in the competition which can, in turn, influence the degree extent of downstream competition; and
- in particular setting a competition spectrum cap too tightly could prevent bidders from obtaining sufficient spectrum in line with their business plans whilst, on the other hand, setting an overly relaxed competition spectrum cap could have adverse effects on downstream competition, including facilitating the "hoarding" of spectrum[154] . As such, competition spectrum caps are an important measure by which to ensure that competition is not harmed or stifled by the competition process itself.

7.56 In light of these factors and responses received to that consultation, ComReg stated that it remains of the view that competition spectrum caps are an important measure by which to ensure that competition in downstream markets is not harmed or stifled by the spectrum assignment competition itself and additionally noted that:

- absent a justified concern in relation to the level of competition in a market/s, ComReg would not normally consider reserving spectrum for new entrants;
- it presently only envisages the use of spectrum competition caps during spectrum assignment competitions; and spectrum competition caps would not stop an operator from acquiring additional rights following a competition [such as by way of transfer or leasing] subject, of course, to

[154] ComReg observes that regulation 17(10) of the Framework Regulations, enables ComReg to 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.

competition law and/or any rule or measures in relation to efficient spectrum use, spectrum trading and/or spectrum hoarding that may apply.

### Relevant Irish developments since 2011

7.57 ComReg has, since 2011, used and proposed the use of, spectrum caps in competitions for spectrum rights of use for ECS.

7.58 In the MBSA process for the 800 MHz, 900 MHz and 1800 MHz bands, ComReg imposed the following competition caps on bidders (either bidding as a single entity or as a consortium of same):

- 2 × 10 MHz of 900 MHz (Time Slice 1 only);
- 2 × 20 MHz of sub-1 GHz spectrum (i.e. 800 MHz and 900 MHz spectrum); and
- 2 × 50 MHz of total spectrum in the three bands.

7.59 In arriving at this position[155], ComReg noted, among other things, that:

- A 900 MHz cap was appropriate for Time Slice 1 as there were likely to be short-run substitutability issues (e.g. equipment/device availability) between the 800 MHz and 900 MHz bands;
- A sub-1GHz spectrum competition cap was appropriate given the particular characteristics of this spectrum (e.g. propagation, equipment availability, etc.); and
- An overall cap was appropriate as it would guard against extreme outcomes which could harm competition while also ensuring that the distribution of spectrum rights are determined by competition amongst the bidders.

7.60 ComReg also considered whether other relevant existing spectrum holdings should count towards the above competition cap. Given that the only other spectrum band of relevance was the 2.1 GHz band, where each of the four incumbent MNOs had 2 × 15 MHz of paired 2.1GHz spectrum at that time, ComReg determined that:

- the size of these existing spectrum holdings were not likely of themselves to be large enough to materially affect the long-run structure of the market after the award process, in light of the total amount of spectrum rights

[155] See Annex 5 of ComReg Document 12/25A for a full discussion of ComReg's position on spectrum caps in the MBSA process.

being made available in the MBSA proposed award (i.e. 2 × 140 MHz); and

- existing spectrum assignments in the 2.1GHz band should not count towards the spectrum competition cap in the MBSA.

7.61 In its proposed award of the 2.6 GHz band and other potential bands (see section 5.5.1 of Document 14/101), ComReg proposed the use of spectrum competition caps. It observed that the extent to which a band-specific or a multi-band cap or both should apply depends on the amount of spectrum available for the award and the extent to which these bands may be substitutable. In addition ComReg noted that:

- new entry could be promoted by "setting aside" spectrum rights for new entrants; and
- should the 700 MHz band be included in the proposed award process, then a band-specific or sub-1GHz spectrum competition cap may also be required in order to promote entry, and in turn, competition.

7.62 In its proposed 3.6 GHz band award, in Consultation 15/70 ComReg expressed its preliminary view that it was appropriate to consider a spectrum competition cap in the range of 150 to 250 MHz.[156]

7.63 In considering whether existing spectrum rights associated with the mobile spectrum bands (i.e. 800 MHz, 900 MHz, 1800 MHz and 2100 MHz) should count towards the above proposed competition cap, ComReg observed that the 3.6 GHz band is unlikely to be a close substitutable to these bands and therefore proposed that existing spectrum holdings should not count towards any competition cap in that particular award process.

7.64 At the same time, ComReg observed that, for certain uses, the 3.6 GHz band may become more substitutable with other "mobile bands" – the 2.3 GHz and/or the 2.6 GHz bands in particular. Accordingly, ComReg noted that 3.6 GHz holdings obtained under its proposed 3.6 GHz band award process may be taken into account for a competition cap in an award of sufficiently substitutable spectrum bands in the future.

### Relevant international developments

7.65 The RSPG, in its Efficient Awards Report, considered the use of spectrum caps and reservations and noted that:

[156] See 5.4 of Document 15/70 for further information.

- in order to promote competition, spectrum managers will often consider spectrum caps as one of the rules of a spectrum award;
- spectrum caps, amongst other measures, can also help to promote new entrants by limiting the spectrum available to incumbents;
- another competition measure is a spectrum reservation, whereby the Member State makes some part of the spectrum available only to particular bidders (usually new entrants or smaller players).

7.66 The RSPG notes the importance of setting a spectrum cap at the right level; too stringent and an operator may be prevented from offering services that will benefit consumers, not stringent enough and competition may be distorted.

7.67 The RSPG also notes that spectrum caps and reservations should reflect the identified objectives of an award based on a market assessment in order to be consistent with competition law.

### ComReg's current thinking

7.68 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 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 outcomes which could harm downstream competition do not emerge from the proposed auction;
- it will consider appropriate measures to promote competition (e.g. new entry) where objectively justified and proportionate;
- it is ComReg's practice to consider, amongst 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 competition; 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.

## 7.6 Spectrum fees

7.69 By way of background, ComReg recalls that:

- Part B of the Authorisation Regulations specifies that conditions relating to spectrum usage fees are one of the conditions which may be attached to a spectrum rights of use;
- Regulation 19 of same provides that such fees should reflect the need to ensure the optimal use of radio spectrum[157]; and
- Wireless Telegraphy regulations made pursuant to Wireless Telegraphy Act 1926 as amended can prescribe the payment of fees on the application, grant or renewal of a licence and the time and manner in which such fees are to be paid.[158]

### ComReg's position in Documents 11/89 and 11/88

7.70 In Documents 11/89 and 11/88, ComReg noted that the effective management of radio spectrum requires more than a purely technical consideration of spectrum efficiency and that functional and economic considerations must also be taken into account, including the extent to which the utilisation of spectrum meets a user's specific needs and the social and economic value that can be derived from it.[159] Given this context ComReg set out its views on a number of fee related matters for the medium term outlook of 3 to 5 years.

7.71 In relation to annual spectrum usage fees, ComReg stated that it will become increasingly important for such fees to be updated on an annual basis to account for the general rate of inflation to ensure that these fees continue to incentivise efficient spectrum use during the licence term. ComReg noted that such indexation will keep the value of these usage fees constant in real terms and, as such, maintain proper incentives for firms to continually assess whether they should continue to hold particular spectrum usage rights.

7.72 In relation to the evolution of Administrative Incentive Pricing (AIP), ComReg stated that it will continue to consider the merits of applying AIP to various spectrum bands and licence types, as it is one of several instruments at ComReg's disposal to encourage the efficient use of spectrum.[160]

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[157] Regulation 19(2) of the Authorisation Regulations requires that 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.

[158] Regulation 6 (1) (g) of the WT Act 1926 as amended by Schedule 2 of the Broadcasting Act, 2009.

[159] "Measuring spectrum efficiency – the art of spectrum utilization metrics" J.W. Burns, Aegis Systems Ltd, United Kingdom. http://www.aegis-systems.co.uk/download/article/ieespectrum1.pdf

[160] ComReg noted that AIP is a mechanism that can be used to promote more intensive spectrum use through an annual administratively set fee and outlined its view that:

### Relevant Irish developments

7.73 In determining the appropriate level of spectrum fees (including the "minimum price" in a competitive award process), ComReg has taken varying approaches depending upon the licence type and the award process.[161]

7.74 While there are various methods[162] of determining the level of a licence fee or the minimum price, ComReg in the past has generally used appropriate benchmarking information tailored to the Irish context and spectrum band/licence type as its preferred approach. For example in the MBSA process, and more recently in ComReg's proposed award of the 3.6 GHz band, relevant benchmarking information has been used to determine (or propose) a conservative minimum price for those award process.[163]

7.75 The timing and manner in which the licence fees are to be paid has also varied per licence type, spectrum band or award process. For most licence types (e.g. radio links, amateur, aircraft, etc.) the licence fees are paid upfront in the application for the licence. For other licence types, including the licences issued on foot of the MBSA process and those proposed for the 3.6 GHz band award, the fees are collected via a combination of an upfront SAF (spectrum access fee) which is generally payable upon completion of the award process and an ongoing SUF (spectrum usage fee) which is payable over the duration of the licence (e.g. payable annually on the anniversary of the licence commencement date).

7.76 In apportioning the minimum price between a minimum upfront SAF (i.e. the reserve price) and an ongoing SUF a number of factors have been considered,

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- that firms that obtained spectrum usage rights in a non-competitive situation could be subject to AIP as such licensees should be given incentives both to use it efficiently and to consider whether there were other potential users who may value the right more than they do.
- it would not generally envisage applying AIP to spectrum rights assigned by auction, as the upfront spectrum fees obtained via such auctions would have been submitted in light of the terms and conditions of the auction, which would have set out the annual spectrum usage fee associated with the duration of the fixed term licence.

[161] For example:

- Consultation 14/101 (paragraph 6.7) and Document 15/70 (paragraph 5.98) identify four factors relevant to the setting of a minimum price in those proposed award processes:
- Section 5.1 of ComReg Document 05/39 ("Review of fees applicable to Rights of Use for Radio Frequencies") lists eight factors that ComReg may take into consideration when setting fees.
- A congestion charge was introduced to the radio links in the 18 GHz and 23 GHz spectrum bands in the Greater Dublin area in light of the congestion of those spectrum bands in that area (ComReg Document 03/124 and S.I. 370 of 2009)

[162] For example administrative costs, low but non-trivial, business modelling, benchmarking, etc.

[163] See section 4.8.4 of Document 12/25 (MBSA) and section 5.7.1 of Document 15/70 (the proposed 3.6 GHz band award)

including: the setting of a minimum upfront SAF to deter frivolous bidding compromising the award process; and the setting of an ongoing SUF to incentivise the return of unused spectrum and to mitigate against the risk of default where too much of the minimum price is deferred into the future in the form of SUFs.[164] ComReg has in the past apportioned the minimum price on a 50/50 basis (for example in the MBSA process and as proposed in Documents 14/101 and 15/70).

7.77 In order to ensure that the SUFs continue to incentivise the efficient use of spectrum over time, ComReg applied an indexation factor to update the fees to account for the general rate of inflation. [165] Such indexation keeps the value of these usage fees constant in real terms and, as such, maintains proper incentives for firms to continually assess whether they should continue to hold particular spectrum usage rights. As the Consumer Price Index (CPI) is the generally accepted means of maintaining a figure constant in real value terms, this is the indexation metric used by ComReg.

### Relevant international developments

7.78 The RSPG, in its Efficient Awards Report, considers spectrum fees and firstly observes that fees are one of the main tools that may be used by Member States to incentivise the efficient use of spectrum. The RSPG also observed some differences in the various approaches used, including:

- A common approach within Europe for auction fees is a combination of up front and staged payments;
- A further model used in some countries is to require the full auction fee to be paid upfront but additionally include an annual fee for the duration of the licence; and
- the example in the UK where upfront fees determined by the auction are collected for the duration of the minimum licence period, and following this annual licence fees based on opportunity cost may be imposed to incentivise continued efficient use of the spectrum and reflect the extended or rolling nature of the licence.

7.79 The RSPG noted that all these above methods can work well and that in all cases, however, there are common principles that should be respected, including:

[164] See section 6.3.1 of Document14/101 and Section 5.8.1 of Document 15/70 for further information.

[165] For example the annual updating of SUFs for CPI is applied to the ESDR, 26 GHz national block , DTT, national telemetry, GSM-R and Liberalised Use Licences, and proposed for the 3.6 GHz band in Document 15/70.

- Transparency over the level of any fees that will be charged over the licence period: bidders need to know what proportion of fees will be required to be paid up front and the extent of any annual fees;
- Certainty that fees will be paid (and a clear understanding of what will happen if they are not): this is particularly important where all or part of the auction fees, are proportioned over the duration of the licence; and
- Appropriate mechanisms in place to incentivise efficient use of the spectrum whilst avoiding undue burdens: this can be achieved through auction fees paid up front, annual licence fees or a combination of both.

### ComReg's current thinking

7.80 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 same;
- 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 the usage 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) to maintain the value of these usage fees constant in real terms.

## 7.7 Coverage/Rollout conditions

### Background and relevant Irish developments

7.81 By way of background, ComReg recalls that:

- A coverage condition is one which requires a spectrum rights holder to provide a defined level of coverage (e.g. on a population or geographic basis) within one or more defined timeframes; and
- A rollout condition is one which requires a spectrum rights holder to provide a defined level of infrastructure deployment (e.g. number of base stations) or service deployment (e.g. the provision of a service in an area) within one or more defined timeframes.

7.82 ComReg observes that the appropriate nature and extent of any coverage and/or rollout condition for a particular a licence type or spectrum band will involve consideration of many factors including:

- The obligation to ensure efficient use of the particular spectrum rights/band, including having regard to the technical characteristics of the particular spectrum right of use/band (e.g. propagation characteristics);
- The objective of safeguarding and promoting competition, such as in terms of:
    - Ensuring that users derive maximum benefits in terms of choice, price and quality;
    - Preventing destabilising competition via “cherry-picking”; and
    - Ensuring that coverage and/or roll-out obligations do not unduly restrict or impede potential new entry;
- The appropriate application of the regulatory principle of taking due account of the variety of conditions relating to competition and consumers that exist in the various geographic areas within the State;
- The appropriate application of the regulatory principle of promoting efficient investment and innovation in new and enhanced infrastructures, which includes considering the potential for the appropriate use of other spectrum rights/bands and/or leasing to count towards such obligations;
- Where the spectrum rights concerned are being used to provide existing services factor such as:
    - the existing levels of operator equipment deployment, such as in terms of quantum and geographic distribution;
    - the nature and extent of consumer expectations in respect of those services;
- where spectrum is being awarded on a service- and technology-neutral basis:
    - Ensuring that coverage and/or roll-out obligations do not unduly restrict or impede the provision of potential services/networks;
    - Having regard to the particular characteristics of services/networks which may be deployed; and
    - the current and likely availability of equipment for the various services/networks and timing of same; and

- ComReg's obligation to ensure that any attachment of conditions to spectrum rights for ECS is non-discriminatory, proportionate and transparent.

7.83 Given the broad range of potentially relevant factors involved and often a complex relationship between same, it is ComReg's practice to determine the appropriate nature and extent of coverage and/or rollout conditions on case by case basis in light of the particular facts and circumstances arising.

7.84 Bearing this in mind, ComReg would nevertheless make the following general observations:

- in the MBSA process, ComReg considered that while retail competition would likely drive actual coverage levels beyond the levels of its proposed obligations, it was nevertheless appropriate to set a coverage obligation given, among other things, there was no guarantee that market forces alone would ensure the efficient use of spectrum and the setting of a coverage obligation would prevent cherry picking (such as in densely populated areas) that could destabilise overall competition (observing that the revenues obtained by MNOs from densely populated areas helped fund the provision of services in less-densely populated areas);
- in Document 15/70 concerning its 3.6 GHz band award, ComReg considered it more appropriate to propose a rollout metric on the deployment of base stations (be that at a high site, a small cell or other cell site type) instead of the typical population- or geographic-based coverage measures. Factors which informed this proposal included the different potential uses of the band and the recent adoption of similar conditions in other Member States including in respect of the 3 .6 GHz band; and
- in some instances the coverage of a particular licensee is set down in legislation as opposed to being specified in its licence. For example, the DTT multiplex licence issued to RTÉ does not contain a coverage obligation given that the Broadcasting Act 2009 requires RTÉ to cover 98% of the population.

7.85 In relation to the above, ComReg further observes that in, some cases, retail competition can and will drive coverage to high levels, while in others this is may not happen without an appropriate obligation. For example, in relation to mobile services provided by the Liberalised Use licences, ComReg observes that the claimed mobile coverage of all operators exceeds the technology and service coverage obligation of 70% of the population in those licences, and it is notable that as of December 2014, Ireland's HSPA 3G coverage was 95% of the

population while Ireland's 4G coverage of 87% population is now above the EU average of 79%.[166]

7.86 In Ireland, and indeed in all other countries where ComReg has considered the current practice of measuring a coverage obligation (see next section below), it is ComReg's general practice to set down the criteria for measuring a coverage obligation in the licence or associated technical documents concerning the particular spectrum assignment(s)[167]. It is also ComReg's general practice that the criteria for coverage measurements are based on relevant technical standards, such as those set down by ETSI and/or the ITU as relevant.

### Relevant international developments

7.87 The RSPG Efficient Awards Report and the RSPG RSPP Opinion both consider the issue of coverage obligations.

7.88 The RSPG Efficient Awards Report noted that a feature common to a number of recent awards is the inclusion of coverage (population or geographic) or roll-out obligations to fit with national policy objectives. These national policy objectives address specific issues which can differ between Member States, such as infrastructure competition, rural coverage, density of population, etc.

7.89 In same report, the RSPG considered that coverage or roll-out obligations at national level can be an important tool to promote broadband access, especially in rural and less economically attractive parts of the country. It notes that where such obligations are imposed they should be appropriate to achieve the identified policy objective, and it considers that coverage obligations are best developed at national level where they can be aligned with national policy and priorities.

7.90 The RSPG RSPP Opinion noted that one of today's political priority issues at national levels and in the EU is ubiquitous broadband connectivity and that in some Member States the focus is on geographical coverage (in particular outside urban areas), and in other cases it is indoor coverage (in urban areas or shopping malls or underground parking areas). The RSPG noted that there are various approaches to addressing coverage issued including :

- incorporating obligations in the licence conditions; and
- national initiatives through potential state funding.

[166] (Digital Agenda Scorecard 2015) https://ec.europa.eu/digital-agenda/download-scoreboard-reports

[167] For example, the coverage metrics for the Liberalised Use coverage obligations are specified in the licence.

7.91 Mobile coverage obligations were also considered by CEPT in the recently published report ECC Report 231[168]. Among other things, this report notes that there are varying ways of measuring a coverage obligation, and that a majority of administrations use technical criteria such as the field strength and signal strength to measure a voice coverage obligation.

### ComReg's current thinking

7.92 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 factors[169] 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 case by case basis in light of the particular facts and circumstances arising;
- It should remain mindful of the potential for competition to drive coverage to high levels.

## 7.8 Mobile retail consumer experience issues

### Relevant Irish developments

7.93 Despite the improvements in the rollout of 3G and 4G mobile services, ComReg notes some recently voiced views which suggest that the mobile consumer experience has deteriorated[170, 171]. On the other hand, ComReg's recent ICT consumer survey indicated that 90% of mobile phone users are satisfied with their service in 2015, up from 76% in 2013.[172]

7.94 ComReg observes there may be various factors contributing to this perception, including:

[168] ECC Report 231, "mobile coverage obligations", 6 March 2015.

[169] 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.

[170] See debate of Oireachtas committee on transport and communications (12 November 2014) and associated press release

[171] See http://www.comreg.ie/_fileupload/publications/ComReg15122.pdf

[172] See Page 63 of http://www.comreg.ie/_fileupload/publications/ComReg15123a.pdf

- the increased use of phones with a poorer antenna sensitivity performance. In that regard, ComReg notes 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 indicated that there is quite a variation in the antenna sensitivity performance of mobile phones with some of the most popular smartphones being at the bottom of the performant list tested;[173]
- changing consumer habits and expectations. Given consumers' increasing consumption of 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;
- 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 900 MHz band, and 4G into 1800 MHz band) and the effect this may have on existing services (e.g. 2G services);
- the use of better building insulation materials (e.g. window insulation/tinting, foil backed insulation) reduces the signal level that reaches indoor areas; and

[173] 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.

Another study for the European Commission's Enterprise and Industry Directorate-General on technical support relating to performance of antennas of mobile phones (2014) -Eurexcem Engineering (January 2014) – states, at page 27, therein that

*"...New systematic and consistent technical requirements for placing a mobile phone on the market in the European Union, which would guarantee that the mobile phone should provide a satisfactory observed radio performance in places where signal from the base station is weak, are technically feasible;*

*...New labelling requirements for placing a mobile phone on the market in the European Union, which would ensure that consumers are informed of the observed radio performance to be expected of a mobile phone in places where the signal from base stations is weak, are technically feasible and could use at least 3 performance levels..."*

In addition, see a 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/

- 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. [174]

7.95 ComReg also observes that there may be various ways of addressing this matter including:

- better informing consumers on how the antenna performance of mobile phones can vary and how this can affect the consumer experience, thereby enabling 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, for this to be effective this would need to be standardised at a European and, ideally, a global level. This is currently being developed by ETSI as part of updating standards for products that fall within the scope of the new Radio Equipment Directive[175];
- ready access 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-emption) to use the radio frequencies; and
- the ability to use fixed broadband connections for the provision of mobile services (both voice and data) to address indoor reception issues.

### ComReg's current thinking

7.96 Given the diverse range of factors that may be affecting the mobile consumer experience (including but not limited to those identified above), ComReg considers that a better understanding of these, and any other relevant, factors

[174] 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

[175] See also COMMISSION IMPLEMENTATING 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.

and the nature and extent of their respective impact on the consumer experience is first required. ComReg observes that such an approach would, firstly, facilitate an informed discussion and ensure that the full range of potential measures are identified and considered. To inform same, ComReg would welcome the views of interested parties on this issue, including on the factors that could be contributing to this perception, the relative importance of such factors and any appropriate measures to address same.

## 7.9 Technology and Service neutrality

### Relevant Irish and International developments

7.97 Previously licences issued were for a particular technology or for the provision of a particular service (e.g. the licences for the GSM technology in the 900 MHz band). However with advances in technology many spectrum bands can now be used by multiple technologies and can provide many different services (e.g. mobile, nomadic, fixed service).

7.98 Under the Common Regulatory Framework (see in particular regulations 18 and 19 of the Framework Regulations), the RSPP Decision (Article 2) and the 2002 Act (section 12), ComReg is obliged to promote technology and service neutrality in spectrum rights of use as appropriate. In addition, many spectrum bands are now being harmonised at a European level via EU or CEPT decisions with the technical conditions (e.g. the block edge mask and channelling arrangements) within which one or more technologies or services can operate. These decision also generally include timeframes for making spectrum available under these conditions.

7.99 While ComReg promotes the application of technology and service neutrality, and takes actions as appropriate to apply such conditions to both existing and new spectrum rights of use, ComReg notes that the “liberalisation” of existing spectrum rights may give rise to competition issues which require careful consideration. For example, in the MBSA process, ComReg facilitated the liberalisation of the existing GSM rights of use in 900 MHz and 1800 MHz bands via the “early liberalisation option” in the auction where the winning bidder paid the opportunity price (as set by the award process) associated with the liberalised spectrum.

### ComReg’s current thinking

7.100 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/or
    - 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.

## 7.10 Transparency of radio spectrum information

### Relevant Irish and International developments

7.101 An ancillary tool to improve the efficient use of spectrum is the publication of radio spectrum information.

7.102 Such publication can contribute to the efficient use of spectrum including by:

- better informing consumers on important parameters such as the coverage or performance of a particular service, thereby empowering consumers to make more informed decisions which, in turn, can improve their user experience;
- better incentivising spectrum rights holders to take measures to improve aspects of their service provision which are particularly valued by consumers (e.g coverage and quality of service);
- better informing interested parties and existing licensees of the areas where other licensees may be open to transferring or leasing spectrum rights. For instance, such publication could enable identification of the spectrum bands and/or geographic areas where spectrum rights are not currently being used licensees, thereby increasing spectrum transfer or leasing activity.

7.103 It is the general practice in Ireland and indeed across Europe to provide transparency on the assignment and usage of radio spectrum. For example:

- In Ireland, ComReg's siteviewer (www.siteviewer.ie) website provides information on the location of the mobile sites in Ireland. Furthermore, information on the GSM, 3G, Liberalised Use, Broadcasting, FWALA, and TPBR licences are published on ComReg's website. For some licence types, the published information included the locations where the licensee can place apparatus, while for others it identifies the licensee or the location of the licensee's licence area;
- In Europe, the EFIS database (www.efis.dk) provides detailed information on each of the administrations (including Ireland) in CEPT. This information relates to allocations, applications, documents, interfaces and rights of use; and
- in 2013, the EU adopted a spectrum inventory decision (Decision 2013/195/EU) defining the practical arrangements, uniform formats and a methodology in relation to the radio spectrum inventory being compiled by the EC. Among other things this decision obliges ComReg to cooperate with the EC to increase the data available on spectrum use, in particular by providing quantitative data such as the number of transmitters, time duration of usage and the coordinates or location information showing the geographical extent of spectrum usage, as well as technologies in use and sharing conditions.

7.104 ComReg is aware that not all radio spectrum information can be published as some information may be confidential (e.g. business secrets).

### ComReg's current thinking

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

Chapter 8

# 8 Next steps and submitting comments

## 8.1 Submitting Comments

8.1 All input and comments are welcome. However, it would make the task of analysing responses easier if comments were referenced to the relevant section / paragraph number in each chapter and annex in this document.

8.2 Please also provide reasoning and supporting information for any views expressed.

8.3 The five week period for comment will run until 16:00 on 18 January 2016, during which time ComReg welcomes written comments on any of the issues raised in this paper.

8.4 Responses must be submitted in written form (post or email) to the following recipient, clearly marked —Submissions to ComReg 15/131:

Divisional Assistant to Market Framework
Commission for Communications Regulation
Irish Life Centre
Abbey Street
Freepost
Dublin 1
Ireland
**D01 W2 H4**
Email: marketframeworkconsult@comreg.ie

8.5 We would request that electronic submissions be submitted in an unprotected format so that they can be included in the ComReg submissions document for electronic publication.

8.6 ComReg appreciates that respondents may wish to provide confidential information to support their views. In order to promote openness and transparency, ComReg will publish all respondents' submissions to, and substantive correspondence relating to, this consultation, subject to the provisions of ComReg's guidelines on the treatment of confidential information[176]. In that regard, respondents are requested to provide both a confidential and non-confidential version of their submission to the consultation,

[176] Document 05/24 - Response to Consultation - Guidelines on the treatment of confidential information - March 2005.

with reasons as to why material marked as confidential is considered to be confidential. Alternatively, respondents are requested to place confidential material in a separate annex to their response, again providing supporting reasoning in that annex as to why such material is confidential.

## 8.2 Next Steps

8.7 Following receipt and consideration of submissions in response to this, and other relevant material, ComReg intends to finalise its strategy for managing the use of radio spectrum in Ireland for the period 2016 – 2018 and publish same alongside a response to consultation document.

# Annex 1: Summary of legal framework and statutory objectives relevant to management of radio spectrum

A 1.1 The Communications Regulation Acts 2002 as amended [177] (the "2002 Act"), the Common Regulatory Framework (including the Framework and Authorisation Directives [178] as transposed into Irish law by the corresponding Framework and Authorisation Regulations[179]), and the Wireless Telegraphy Acts1926 to 2009[180] set out, amongst other things, powers, functions, duties and objectives of ComReg that are relevant to the management of the radio frequency spectrum in Ireland and to this preliminary consultation.

A 1.2 Apart from licensing and making regulations in relation to licences, ComReg's functions include the management of Ireland's radio frequency spectrum in accordance with ministerial Policy Directions under Section 13 of the 2002 Act, having regard to its objectives under Section 12 of the 2002 Act, Regulation 16 of the Framework Regulations and the provisions of Article 8a of the Framework Directive. ComReg is to carry out its functions effectively, and in a manner serving to ensure that the allocation and assignment of radio frequencies is based on objective, transparent, non-discriminatory and proportionate criteria.

A 1.3 This annex is intended as a general guide as to ComReg's role in this area, and not as a definitive or exhaustive legal exposition of that role. Further, this annex restricts itself to consideration of those powers, functions, duties and objectives of ComReg that appear most relevant to the matters at hand and generally excludes those not considered relevant (for example, in relation to

[177] 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.

[178] 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")

[179] 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.

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

postal services, premium rate services or market analysis). For the avoidance of doubt, however, the inclusion of particular material in this Annex does not necessarily mean that ComReg considers same to be of specific relevance to the matters at hand.

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

## A2.1 Primary Objectives and Regulatory Principles under the 2002 Act and Common Regulatory Framework

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

- promote competition[181];
- contribute to the development of the internal market[182];
- promote the interests of users within the Community[183];
- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under Section 13 of the 2002 Act[184]; and
- unless otherwise provided for in Regulation 17 of the Framework Regulations, take the utmost account of the desirability of technological neutrality in complying with the requirements of the Specific Regulations [185] in particular those designed to ensure effective competition [186].

[181] Section 12 (1)(a)(i) of the 2002 Act.

[182] Section 12 (1)(a)(ii) of the 2002 Act.

[183] Section 12(1)(a)(iii) of the 2002 Act.

[184] 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.

[185] 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).

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

### A2.1.1 Promotion of Competition

A 1.6 Section 12(2)(a) of the 2002 Act requires ComReg to take all reasonable measures which are aimed at the promotion of competition, including:

- ensuring that users, including disabled users, derive maximum benefit in terms of choice, price and quality;
- ensuring that there is no distortion or restriction of competition in the electronic communications sector; and
- encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources.

A 1.7 In so far as the promotion of competition is concerned, Regulation 16(1)(b) of the Framework Regulations also requires ComReg to:

- ensure that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality, and
- ensure that, in the transmission of content, there is no distortion or restriction of competition in the electronic communications sector.

A 1.8 Regulation 9(11) of the Authorisation Regulations also provides that ComReg must ensure that radio frequencies are efficiently and effectively used having regard to Section 12(2)(a) of the 2002 Act and Regulations 16(1) and 17(1) of the Framework Regulations. Regulation 9(11) further provides that ComReg must ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies, and, for this purpose, ComReg may take appropriate measures such as mandating the sale or the lease of rights of use for radio frequencies.

### A2.1.2 Contributing to the Development of the Internal Market

A 1.9 Section 12(2)(b) of the 2002 Act requires ComReg to take all reasonable measures which are aimed at contributing to the development of the internal market, including:

- removing remaining obstacles to the provision of electronic communications networks, electronic communications services and associated facilities at Community level;
- encouraging the establishment and development of trans-European networks and the interoperability of transnational services and end-to-end connectivity; and

- co-operating with electronic communications national regulatory authorities in other Member States of the Community and with the Commission of the Community in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of Community law in this field.

A 1.10 In so far as contributing to the development of the internal market is concerned, Regulation 16(1)(c) of the Framework Regulations also requires ComReg to co-operate with the Body of European Regulators for Electronic Communications (BEREC) in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of EU law in the field of electronic communications.

### A2.1.3 Promotion of Interests of Users

A 1.11 Section 12(2)(c) of the 2002 Act requires ComReg, when exercising its functions in relation to the provision of electronic communications networks and services, to take all reasonable measures which are aimed at the promotion of the interests of users within the Community, including:

- ensuring that all users have access to a universal service;
- ensuring a high level of protection for consumers in their dealings with suppliers, in particular by ensuring the availability of simple and inexpensive dispute resolution procedures carried out by a body that is independent of the parties involved;
- contributing to ensuring a high level of protection of personal data and privacy;
- promoting the provision of clear information, in particular requiring transparency of tariffs and conditions for using publicly available electronic communications services;
- encouraging access to the internet at reasonable cost to users;
- addressing the needs of specific social groups, in particular disabled users; and
- ensuring that the integrity and security of public communications networks are maintained.

A 1.12 In so far as promotion of the interests of users within the EU is concerned, Regulation 16(1)(d) of the Framework Regulations also requires ComReg to:

- address the needs of specific social groups, in particular, elderly users and users with special social needs, and

- promote the ability of end-users to access and distribute information or use applications and services of their choice.

### A2.1.4 Regulatory Principles

A 1.13 In pursuit of its objectives under Regulation 16(1) of the Framework Regulations and Section 12 of the 2002 Act, ComReg must apply objective, transparent, non-discriminatory and proportionate regulatory principles by, amongst other things:

- promoting regulatory predictability by ensuring a consistent regulatory approach over appropriate review periods;

- ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services;

- safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure-based competition;

- promoting efficient investment and innovation in new and enhanced infrastructures, including by ensuring that any access obligation takes appropriate account of the risk incurred by the investing undertakings and by permitting various cooperative arrangements between investors and parties seeking access to diversify the risk of investment, while ensuring that competition in the market and the principle of non-discrimination are preserved;

- taking due account of the variety of conditions relating to competition and consumers that exist in the various geographic areas within the State; and

- imposing ex-ante regulatory obligations only where there is no effective and sustainable competition and relaxing or lifting such obligations as soon as that condition is fulfilled.

### A2.1.5 BEREC

A 1.14 Under Regulation 16(1)(3) of the Framework Regulations, ComReg must:

- having regard to its objectives under Section 12 of the 2002 Act and its functions under the Specific Regulations, actively support the goals of BEREC of promoting greater regulatory co-ordination and coherence; and

- take the utmost account of opinions and common positions adopted by BEREC when adopting decisions for the national market.

### A2.1.6 Other Obligations under the 2002 Act

A 1.15 In carrying out its functions, ComReg is required amongst other things, to:

- seek to ensure that any measures taken by it are proportionate having regard to the objectives set out in Section 12 of the 2002 Act;[187]

- have regard to international developments with regard to electronic communications networks and electronic communications services, associated facilities, postal services, the radio frequency spectrum and numbering[188]; and

- take the utmost account of the desirability that the exercise of its functions aimed at achieving its radio frequency management objectives does not result in discrimination in favour of or against particular types of technology for the provision of ECS.[189]

### A2.1.7 Policy Directions[190]

A 1.16 Section 12(4) of the 2002 Act provides that, in carrying out its functions, ComReg must have appropriate regard to policy statements, published by or on behalf of the Government or a Minister of the Government and notified to the Commission, in relation to the economic and social development of the State. Section 13(1) of the 2002 Act requires ComReg to comply with any policy direction given to ComReg by the Minister for Communications, Energy and Natural Resources ("the Minister") as he or she considers appropriate, in the interests of the proper and effective regulation of the electronic communications market, the management of the radio frequency spectrum in the State and the formulation of policy applicable to such proper and effective regulation and management, to be followed by ComReg in the exercise of its functions. Section 10(1)(b) of the 2002 Act also requires ComReg, in managing the radio frequency spectrum, to do so in accordance with a direction of the Minister under Section 13 of the 2002 Act, while Section 12(1)(b) requires ComReg to ensure the efficient management and use of the radio frequency spectrum in accordance with a direction under Section 13.

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[187] Section 12(3) of the 2002 Act.

[188] Section 12(5) of the 2002 Act.

[189] Section 12(6) of the 2002 Act .

[190] 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 1.17 The Policy Directions which are most relevant in this regard include the following:

### Policy Direction No.3 on Broadband Electronic Communication Networks

A 1.18 ComReg shall in the exercise of its functions, take into account the national objective regarding broadband rollout, viz, the Government wishes to ensure the widespread availability of open-access, affordable, always-on broadband infrastructure and services for businesses and citizens on a balanced regional basis within three years, on the basis of utilisation of a range of existing and emerging technologies and broadband speeds appropriate to specific categories of service and customers.

A 1.19 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

A 1.20 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

A 1.21 Where ComReg has discretion as to whether to impose regulatory obligations, it shall, before deciding to impose such regulatory obligations on undertakings, examine whether the objectives of such regulatory obligations would be better achieved by forbearance from imposition of such obligations and reliance instead on market forces.

### Policy Direction No.6 on Regulatory Impact Assessment

A 1.22 ComReg, before deciding to impose regulatory obligations on undertakings in the market for electronic communications or for the purposes of the management and use of the radio frequency spectrum or for the purposes of the regulation of the postal sector, shall conduct a Regulatory Impact Assessment in accordance with European and International best practice and otherwise in accordance with measures that may be adopted under the Government's Better Regulation programme.

### Policy Direction No.7 on Consistency with other Member States

A 1.23 ComReg shall ensure that, where market circumstances are equivalent, the regulatory obligations imposed on undertakings in the electronic communications market in Ireland should be equivalent to those imposed on

undertakings in equivalent positions in other Member States of the European Community.

### Policy Direction No.11 on the Management of the Radio Frequency Spectrum

A 1.24 ComReg shall ensure that, in its management of the radio frequency spectrum, it takes account of the interests of all users of the radio frequency spectrum.

### General Policy Direction No.1 on Competition (2004)

A 1.25 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.

## A2.2 Other Relevant Obligations under the Framework and Authorisation Regulations

### A2.2.1 Framework Regulations

A 1.26 Regulation 17 of the Framework Regulations governs the management of radio frequencies for electronic communications services. Regulation 17(1) requires that ComReg, subject to any directions issued by the Minister pursuant to Section 13 of the 2002 Act and having regard to its objectives under Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations and the provisions of Article 8a of the Framework Directive, ensure:

- the effective management of radio frequencies for electronic communications services;

- that spectrum allocation used for electronic communications services and issuing of general authorisations or individual rights of use for such radio frequencies are based on objective, transparent, non-discriminatory and proportionate criteria; and

- ensure that harmonisation of the use of radio frequency spectrum across the EU is promoted, consistent with the need to ensure its effective and efficient use and in pursuit of benefits for the consumer such as economies of scale and interoperability of services, having regard to all decisions and measures adopted by the European Commission in accordance with Decision No. 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the EU.

A 1.27 Regulation 17(2) provides that, unless otherwise provided in Regulation 17(3), ComReg must ensure that all types of technology used for electronic communications services may be used in the radio frequency bands that are declared available for electronic communications services in the Radio Frequency Plan published under Section 35 of the 2002 Act in accordance with EU law.

A 1.28 Regulation 17(3) provides that, notwithstanding Regulation 17(2), ComReg may, through licence conditions or otherwise, provide for proportionate and non-discriminatory restrictions to the types of radio network or wireless access technology used for electronic communications services where this is necessary to—

- avoid harmful interference,

- protect public health against electromagnetic fields,

- ensure technical quality of service,

- ensure maximisation of radio frequency sharing,

- safeguard the efficient use of spectrum, or

- ensure the fulfilment of a general interest objective as defined by or on behalf of the Government or a Minister of the Government in accordance with Regulation 17(6).

A 1.29 Regulation 17(4) requires that, unless otherwise provided in Regulation 17(5), ComReg must ensure that all types of electronic communications services may be provided in the radio frequency bands, declared available for

electronic communications services in the Radio Frequency Plan published under Section 35 of the Act of 2002 in accordance with EU law.

A 1.30 Regulation 17(5) provides that, notwithstanding Regulation 17(4), ComReg may provide for proportionate and non-discriminatory restrictions to the types of electronic communications services to be provided, including where necessary, to fulfil a requirement under the International Telecommunication Union Radio Regulations ("ITU-RR").

A 1.31 Regulation 17(6) requires that measures that require an electronic communications service to be provided in a specific band available for electronic communications services must be justified in order to ensure the fulfilment of a general interest objective as defined by or on behalf of the Government or a Minister of the Government in conformity with EU law such as, but not limited to—

- safety of life,
- the promotion of social, regional or territorial cohesion,
- the avoidance of inefficient use of radio frequencies, or
- the promotion of cultural and linguistic diversity and media pluralism, for example, by the provision of radio and television broadcasting services.

A 1.32 Regulation 17(7) provides that ComReg may only prohibit the provision of any other electronic communications service in a specific radio spectrum frequency band where such a prohibition is justified by the need to protect safety of life services. ComReg may, on an exceptional basis, extend such a measure in order to fulfil other general interest objectives as defined by or on behalf of the Government or a Minister of the Government.

A 1.33 Regulation 17(8) provides that ComReg must, in accordance with Regulation 18, regularly review the necessity of the restrictions referred to in Regulations 17(3) and 17(5) and must make the results of such reviews publicly available.

A 1.34 Regulation 17(9) provides that Regulations 17(2) to (7) only apply to spectrum allocated to be used for electronic communications services, general authorisations issued and individual rights of use for radio frequencies granted after the 1 July 2011. Spectrum allocations, general authorisations and individual rights of use which already existed on the 1 July 2011 Framework Regulations are subject to Regulation 18.

A 1.35 Regulation 17(10) provides that ComReg may, having regard to its objectives under Section 12 of the 2002 Act and Regulation 16 and its functions under the Specific Regulations, lay down rules in order to prevent spectrum hoarding, in particular by setting out strict deadlines for the effective

exploitation of the rights of use by the holder of rights and by withdrawing the rights of use in cases of non-compliance with the deadlines. Any rules laid down under this Regulation must be applied in a proportionate, non-discriminatory and transparent manner.

A 1.36 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.

## A2.2.2 Authorisation Regulations

### Decision to limit rights of use for radio frequencies

A 1.37 Regulation 9(2) of the Authorisation Regulations provides that ComReg may grant individual rights of use for radio frequencies by way of a licence where it considers that one or more of the following criteria are applicable:

- it is necessary to avoid harmful interference,
- it is necessary to ensure technical quality of service,
- it is necessary to safeguard the efficient use of spectrum, or
- it is necessary to fulfil other objectives of general interest as defined by or on behalf of the Government or a Minister of the Government in conformity with EU law.

A 1.38 Regulation 9(10) of the Authorisation Regulations provides that ComReg must not limit the number of rights of use for radio frequencies to be granted except where this is necessary to ensure the efficient use of radio frequencies in accordance with Regulation 11.

A 1.39 Regulation 9(7) also provides that:

- where individual rights of use for radio frequencies are granted for a period of 10 years or more and such rights may not be transferred or leased between undertakings in accordance with Regulation 19 of the Framework Regulations, ComReg must ensure that criteria set out in Regulation 9(2) apply for the duration of the rights of use, in particular upon a justified request from the holder of the right.
- where ComReg determines that the criteria referred to in Regulation 9(2) are no longer applicable to a right of use for radio frequencies, ComReg must, after a reasonable period and having notified the holder of the individual rights of use, change the individual rights of use into a general authorisation or must ensure that the individual

rights of use are made transferable or leasable between undertakings in accordance with Regulation 19 of the Framework Regulations.

## Publication of procedures

A 1.40 Regulation 9(4)(a) of the Authorisation Regulations requires that ComReg, having regard to the provisions of Regulation 17 of the Framework Regulations, establish open, objective, transparent, non-discriminatory and proportionate procedures for the granting of rights of use for radio frequencies and cause any such procedures to be made publicly available.

## Duration of rights of use for radio frequencies

A 1.41 Regulation 9(6) of the Authorisation Regulations provides that rights of use for radio frequencies must be in force for such period as ComReg considers appropriate having regard to the network or service concerned in view of the objective pursued taking due account of the need to allow for an appropriate period for investment amortisation.

## Conditions attached to rights of use for radio frequencies

A 1.42 Regulation 9(5) of the Authorisation Regulations provides that, when granting rights of use for radio frequencies, ComReg must, having regard to the provisions of Regulations 17 and 19 of the Framework Regulations, specify whether such rights may be transferred by the holder of the rights and under what conditions such a transfer may take place.

A 1.43 Regulation 10(1) of the Authorisation Regulations provides that, notwithstanding Section 5 of the Wireless Telegraphy Act,1926, but subject to any regulations under Section 6 of that Act, ComReg may only attach those conditions listed in Part B of the Schedule to the Authorisation Regulations. Part B lists the following conditions which may be attached to rights of use:

- Obligation to provide a service or to use a type of technology for which the rights of use for the frequency has been granted including, where appropriate, coverage and quality requirements.

- Effective and efficient use of frequencies in conformity with the Framework Directive and Framework Regulations.

- Technical and operational conditions necessary for the avoidance of harmful interference and for the limitation of exposure of the general public to electromagnetic fields, where such conditions are different from those included in the general authorisation.

- Maximum duration in conformity with Regulation 9, subject to any changes in the national frequency plan.
- Transfer of rights at the initiative of the rights holder and conditions of such transfer in conformity with the Framework Directive.
- Usage fees in accordance with Regulation 19.
- Any commitments which the undertaking obtaining the usage right has made in the course of a competitive or comparative selection procedure.
- Obligations under relevant international agreements relating to the use of frequencies.
- Obligations specific to an experimental use of radio frequencies.

A 1.44 Regulation 10(2) also requires that any attachment of conditions under Regulation 10(1) to rights of use for radio frequencies must be non-discriminatory, proportionate and transparent and in accordance with Regulation 17 of the Framework Regulations.

## Procedures for limiting the number of rights of use to be granted for radio frequencies

A 1.45 Regulation 11(1) of the Authorisation Regulations provides that, where ComReg considers that the number of rights of use to be granted for radio frequencies should be limited it must, without prejudice to Sections 13 and 37 of the 2002 Act:

- give due weight to the need to maximise benefits for users and to facilitate the development of competition, and
- give all interested parties, including users and consumers, the opportunity to express their views in accordance with Regulation 12 of the Framework Regulations.

A 1.46 Regulation 11(2) of the Authorisation Regulations requires that, when granting the limited number of rights of use for radio frequencies it has decided upon, ComReg does so *"…on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to the achievement of the objectives set out in Section 12 of the 2002 Act and Regulations 16 and 17 of the Framework Regulations."*

A 1.47 Regulation 11(4) provides that where it decides to use competitive or comparative selection procedures, ComReg must, inter alia, ensure that such procedures are fair, reasonable, open and transparent to all interested parties.

### Fees for spectrum rights of use

A 1.48 Regulation 19 of the Authorisation Regulations permits ComReg to impose fees for rights of use which reflect the need to ensure the optimal use of the radio frequency spectrum.

A 1.49 ComReg is required to ensure that any such fees are objectively justified, transparent, non-discriminatory and proportionate in relation to their intended purpose and take into account the objectives of ComReg as set out in Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations.

### Amendment of rights and obligations

A 1.50 Regulation 15 of the Authorisation Regulations permits ComReg to amend rights and conditions concerning rights of use, provided that any such amendments may only be made in objectively justified cases and in a proportionate manner, following the process set down in Regulation 15(4).

## A2.3 Other Relevant Provisions

### Wireless Telegraphy Act, 1926 as amended (the "1926 Act")

A 1.51 Under Section 5(1) of the 1926 Act, ComReg may, subject to that Act, and on payment of the prescribed fees (if any), grant to any person a licence to keep and have possession of apparatus for wireless telegraphy in any specified place in the State.

A 1.52 Section 5(2) provides that, such a licence shall be in such form, continue in force for such period and be subject to such conditions and restrictions (including conditions as to suspension and revocation) as may be prescribed in regard to it by regulations made by ComReg under Section 6.

A 1.53 Section 5(3) also provides that, where it appears appropriate to ComReg, it may, in the interests of the efficient and orderly use of wireless telegraphy, limit the number of licences for any particular class or classes of apparatus for wireless telegraphy granted under Section 5.

A 1.54 Section 6 provides that ComReg may make regulations prescribing in relation to all licences granted by it under Section 5, or any particular class or classes of such licences, all or any of the following matters:

- the form of such licences,
- the period during which such licences continue in force,
- the manner in which, the terms on which, and the period or periods for which such licences may be renewed,

- the circumstances in which or the terms under which such licences are granted,
- the circumstances and manner in which such licences may be suspended or revoked by ComReg,
- the terms and conditions to be observed by the holders of such licences and subject to which such licences are deemed to be granted,
- the fees to be paid on the application, grant or renewal of such licences or classes of such licences, subject to such exceptions as ComReg may prescribe, and the time and manner at and in which such fees are to be paid, and
- matters which such licences do not entitle or authorise the holder to do.

A 1.55 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")

A 1.56 Section 132 of the 2009 Act relates to the duties of ComReg in respect of the licensing of spectrum for use in establishing digital terrestrial television multiplexes and places an obligation on ComReg to issue:

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

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

A 1.57 Article 4 of the Competition Directive provides that:

> *"Without prejudice to specific criteria and procedures adopted by Member States to grant rights of use of radio frequencies to providers of radio or television broadcast content services with a view to pursuing general interest objectives in conformity with Community law:*
>
> - Member States shall not grant exclusive or special rights of use of radio frequencies for the provision of electronic communications services.

- The assignment of radio frequencies for electronic communication services shall be based on objective, transparent, non-discriminatory and proportionate criteria."

## Radio Spectrum Policy Programme

A 1.58 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.

A 1.59 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.

# Annex 2: Methodology for calculating the Contribution of Radio Spectrum

A 1.60 Section 3 of this document presents the contribution of radio spectrum to the Gross Domestic Product of Ireland over the five year period 2009 – 2013. The methodology used to make this calculation is based on the value added[191] 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.

A 1.61 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.

A 1.62 This calculation uses the income approach to calculate the contribution of GDP.[192] 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:

$$GDP = Gross\ Operating\ Surplus + Compensation\ of\ Employees + mixed\ income + taxes\ on\ production\ less\ subsidies$$ [193]

A 1.63 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

[191] Value 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.

[192] This 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.

[193] Mixed 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.

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.[194]

A 1.64 The estimate of GDP contribution is qualified in two important respects. First, the estimate excludes small companies to which the Companies (Amendment) Act 1986 applies[195] 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.

A 1.65 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.

A 1.66 These two qualifications result in a conservative estimate.

[194] In 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.

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

# Annex 3: A band-by-band consideration of ComReg's spectrum workload

A 1.67 This annex sets out a band-by-band and a development-by-development consideration of ComReg's spectrum workload. In particular, this annex considers the:

- licences expiring in the period 2015 to 2021;
- additional spectrum bands that could be considered for assignment in the period 2016 to 2018; and
- other developments (e.g. legislation, etc.) currently envisaged which can affect ComReg's workload.

## Licences expiring in period 2015-2021

A 1.68 Table 3 below sets out the existing licences which are due to expire in the period 2015 to 2021 (i.e. three years following the 2016 to 2018 timeframe of this consultation), the current status of these bands, and ComReg's envisaged next steps on each band.

**Table 3: Existing Licences expiring in the period 2015-2021[196], current status and ComReg's preliminary view on next steps**

| Spectrum Band (Licence type) | Assignments and current Licensee | Expiry | Current status, ComReg's observations and envisaged next steps |
|---|---|---|---|
| VHF/UHF (TPBR[197]) | Various | **2015 to 2016** (December 2015 to December 2016) | This is a ComReg action plan[198] item for the ComReg financial year to 30 June 2016.<br>Document 15/109 outlines ComReg's position that the TPBR licensing scheme is being re-opened.<br>Documents 05/82aR3 and 05/82R3 set out the application form and guidelines for applicants. |

[196] Note: No licences expire in 2020 and 2021

[197] TPBR = Third Party Business Radio – see Document 10/101.

[198] http://www.comreg.ie/_fileupload/Annual%20Action%20Plan%20Ye%20300616.pdf

| Spectrum Band (Licence type) | Assignments and current Licensee | Expiry | Current status, ComReg's observations and envisaged next steps |
|---|---|---|---|
| 900 MHz (WDMDS[199]) | Digiweb (872 – 876 MHz 917 – 921 MHz) | **2015** (05 December) | ComReg observes that :<br>• this is a non-harmonised band;<br>• under the current WDMDS licence there is very limited use of this band; and<br>• within CEPT this band is of significant interest to Short Range Devices (SRD)[200] for services such as smart metering, and that harmonisation studies are ongoing.<br>ComReg's envisaged next step is that following the expiry of this licence, this band should be designated and made available to SRDs and that ComReg Document 02/71 would be updated as appropriate. |
| 400 MHz (WDMDS) | Wirefree Communications (410 – 412 MHz 420 – 422 MHz) | **2015** (07 December) | ComReg observes that<br>• this is a non-harmonised band;<br>• under the current WDMDS licence there was no use made of this band;<br>• within Europe there are various land mobile uses possible;<br>• within the UK part of this band is assigned to is used by Arqiva & Airwave solutions limited for smart metering;<br>• this band forms part of the spectrum bands identified by CEPT for BB-PPDR<br>Given its favourable propagation characteristics ComReg observes that there may be some interest in this band. However the urgency of this interest is likely to be of a lower priority compared to the interest for spectrum in other bands (e.g. the 3.6 GHz band).<br>Further, ComReg observes that harmonisation activities in this band (e.g. BB-PPDR), and in other bands (e.g. the potential use of SRDs for smart metering in the 870 – 876 MHz / 915 – 921 MHz band) may influence the interest in this band. This suggests that it may be more appropriate to monitor the potential uses for this band before finalising any views |
| | Wirefree Communications (412 – 414 MHz 422 – 424 MHz) | **2015** (07 December) | |

[199] WDMDS = Wideband Digital Mobile Data Services – see Document 05/80.

[200] See for example ECC Report 189

| Spectrum Band (Licence type) | Assignments and current Licensee | Expiry | Current status, ComReg's observations and envisaged next steps |
|---|---|---|---|
| 2.6 GHz (MMDS) | Various UPC (2524 -2668 MHz) | **2016** (18 April) | Current status:<br>• UPC's MMDS licences expire on 18 April 2016.<br>• Document 14/101 – Consultation on the release of the 2.6 GHz band with other bands.<br>• Document 15/70 – Consultation on the 3.6 GHz band.<br>From the responses to Document 14/101, ComReg observes that:<br>• there is interest in the release of this band, and<br>• the timeline for the release of this band would depend on factors such as the other bands that would be awarded in the same process.<br>Further information on the 2.6 GHz band is likely to be provided from the second half of 2016 onwards |
| 3.6 GHz (FWALA[201]) | Numerous | **2017** (31 July) | This is a ComReg action plan item for the ComReg year to 30 June 2016.<br>Current Status: Documents 10/29, 14/101 and 15/14, 15/70<br>ComReg's envisaged next steps include:<br>• the issue of a response to consultation and Draft Decision in Q4'15<br>The timeframe for the completion of a 3.6 GHz award process will depend on many factors including interested parties responses to ComReg's consultations. |

[201] FWALA = Fixed Wireless Access Local Area – Document 10/29

| Spectrum Band (Licence type) | Assignments and current Licensee | Expiry | Current status, ComReg's observations and envisaged next steps |
|---|---|---|---|
| 26 GHz National Block Licences | Numerous | **2018** (5 June) | ComReg observes that:<br>• this band is being used for the provision of point to point radio link services;<br>• there is likely to be interest in the relicensing of this band to facilitate current users;<br>• There may be additional demand for unused radio spectrum for either point-to-point or point-to-multipoint services (PMP), albeit currently there are no PMP services in this band;<br>Further information on this band is likely to be provided in early 2017 |
| UHF band | RTÉ DTT (470-790 MHz) | **2019** (19 December) | ComReg observes that:<br>• spectrum across the UHF band is being used for the provision of DTT services;<br>• across Europe DTT services are being migrated from the 700 MHz band (694 MHz to 790 MHz) given the ongoing harmonisation activities (see section 6.1.2 below);<br>• there is likely to be interest in the re-licensing of DTT services in the UHF band, although this would depend on many factors including the government's policies regarding DTT; and<br>• ComReg is required under the Broadcasting Act 2009 to licence RTÉ to facilitate its operation of DTT services in the UHF band. |
| LF band | RTÉ Long-wave (150 – 285 kHz) | **2019** (13 May) | ComReg observes that:<br>• current indications suggest that this service will cease prior to the expiry of licence; and<br>• ComReg is required under the Broadcasting Act 2009 to licence RTÉ to facilitate its operation of LF radio services in the LF band. |
| VHF Band II | RTÉ FM (87.5 – 108 MHz) | **2019** (13 May) | ComReg observes that:<br>• there is a strong demand for analogue FM sound broadcasting services; and<br>• ComReg is required under the Broadcasting Act 2009 to licence RTÉ to facilitate its operation of FM radio services in the LF band. |

| Spectrum Band (Licence type) | Assignments and current Licensee | Expiry | Current status, ComReg's observations and envisaged next steps |
|---|---|---|---|
| VHF Band III | RTÉ DAB/DAB+ (174 – 230 MHz) | **2019** (13 May) | ComReg observes that:<br>• the RTÉ NL DAB MUX (multiplex) on channel 12C – 227.360 MHz has 54% population coverage and is available in Cork and Limerick cities and the greater Dublin area. (source www.rte.ie 17 September 2015).<br>• ComReg is required under the Broadcasting Act 2009 to licence RTÉ to facilitate its operation of digital sound broadcasting services in VHF band III. |

## Additional spectrum bands that could be considered for assignment in the period 2016-2018

A 1.69 Table 4 sets out the additional spectrum bands that could be considered for assignment in the period 2016-2018, and ComReg's envisaged next steps on each band.

## Table 4: Additional spectrum that could be considered for assignment in the period 2016-2018

| Spectrum Band | Current status, ComReg's observations and envisaged next steps |
|---|---|
| 700 MHz<br>(694 – 790 MHz) | This is a ComReg action plan item for the ComReg year to 30 June 2016.<br>This spectrum is currently licensed to the DTT services and across Europe DTT services are being migrated from this band<br>In March 2015, harmonised technical conditions for mobile/fixed communications networks (MFCN) were adopted by CEPT via ECC/DEC/(15)01<br>An EC decision is envisaged in 2016. This may include the setting of a deadline by which all EU Member States shall make the 700 MHz band available for mobile broadband[202]<br>The future use of the 700 MHz band has been discussed by ComReg in Documents 14/101, 15/62 and 15/70.<br>Document 15/62 indicates that the 700 MHz band would provide a positive Net Present benefit of circa €91m and that ComReg is of the view that the 700 MHz band can and should be repurposed in line with international harmonisation measures.<br>From the responses to Consultation 14/101, ComReg observes that<br>• There is likely to be interest in this band; and<br>• Some respondents suggested that the 700 MHz band would be a preferable focus of the next multi-band spectrum assignment process.<br>Further information on the future of this band is likely to be provided in the second half of 2016. |
| 1.4 GHz<br>(1452-1492 MHz) | There are no spectrum assignments in this band in Ireland.<br>In May 2015, the EC adopted an implementing decision (EU) 2015/750 on the harmonisation of the 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union.<br>In July 2015, the CEPT amended its decision on the use of this band for Mobile/Fixed Communications Networks Supplemental Downlink (see ECC/DEC/(13)03)<br>The future use of the 1.4 GHz band has been discussed by ComReg in Consultation 14/101 and Document 15/70.<br>From the responses to Consultation 14/101, ComReg observes that there is likely to be interest in this band.<br>Further information on the future of this band is likely to be provided in the second half of 2016. |

[202] See section 3.1 of the EC's Digital Single Market strategy for Europe

| Spectrum Band | Current status, ComReg's observations and envisaged next steps |
|---|---|
| 1900-1920 MHz | The CEPT has finalised a decision on this band for DA2GC (see ECC/DEC/(15)02). In addition, the CEPT also identified the band 5855-5875 MHz as another harmonised band for DA2GC.<br>Up until October 2015, the EC was considering a harmonisation measure for this band, but this process appears to now have been stopped.<br>ComReg intends to monitor the situation closely (as required) but observes that, given the higher priority of other spectrum projects, any action on this project is likely to be a low priority in the short term. ComReg will continue to respect the existing rights of use in the band. |
| 1980-2010 / 2170 – 2200 | In May 2009, Inmarsat Ventures Limited and Solaris Mobile Limited were selected[203] as the operators to provide a MSS with CGC service on a pan-European level in this band. To date and more than 6 years later, no services have been launched.<br>ComReg observes that by May 2016 (i.e. 7 years after the EC Decision) each of the licensees need to prove that they have achieved their rollout and coverage obligations[204].<br>ComReg's priority of the CGC issue is contingent on the successful satellite launch by these operators and consideration of other matters such as the compliance of the MSS operators with its rollout and coverage obligations. |
| 2.3 GHz (2300 – 2400 MHz) | The majority of this spectrum band is unassigned, although part of this spectrum band is licensed to the eircom for its Rurtel service.<br>In June 2014, harmonised technical and regulatory conditions for mobile/fixed communications networks (MFCN) were adopted by CEPT via ECC/DEC/(14)02.<br>A European Commission technical harmonisation decision is currently being discussed within the EC's Radio Spectrum Committee.<br>The future use of the 2.3 GHz band has been discussed by ComReg in Consultation 14/101 and Document 15/70.<br>From the responses to Consultation 14/101, ComReg observes that there is likely to be interest in this band.<br>Further information on the future of this band is likely to be provided in the second half of 2016. |
| 10 GHz (10-10.154 GHz) | In the responses to Document 14/101, one respondent Viatel expressed an interest in the 10-10.154 GHz spectrum band in order to deliver broadband services, although it also stated that the window of opportunity for using this spectrum is closing.<br>ComReg previously considered releasing the band 10.000 to 10.450 (including 10 to 10.154) in Document 09/36 where it proposed to monitor future developments in relation to the band. ComReg did not find cause to licence the band at that time and would query whether developments might warrant further consideration of the matter now. |

[203] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:149:0065:0068:EN:PDF

[204] MSS shall be available in all Member States and to at least 50 % of the population and over at least 60 % of the aggregate land area of each Member State by the time stipulated by the applicant but in any event no later than seven years from the date of publication of the Commission's decision

| Spectrum Band | Current status, ComReg's observations and envisaged next steps |
|---|---|
| 42 GHz | In light of considerations of the future use of national block licensing in the 26 GHz band further national block licensing could be considered in the 42 GHz band if warranted |

## Other developments

A 1.70 ComReg's workload is influenced by a wide range of external other developments including national or EU legislation/policy developments, sector-specific or licensee requests, etc.

A 1.71 Table 5 below sets out a list of the currently foreseen other developments, their current status and ComReg's observations of these.

**Table 5: A list of other developments currently envisaged that can influence ComReg's spectrum workload.**

| Developments | Current status and ComReg's observations |
|---|---|
| Liberalisation of the paired 2 GHz band | EU Decision 2012/688/EU harmonises the conditions for the availability and efficient use of the frequency bands 1920- 1980 MHz and 2110-2170 MHz (hereafter 'the paired terrestrial 2 GHz band') for terrestrial systems capable of providing electronic communications services in the Union.<br>Document 14/65 sets out ComReg's preliminary consultation.<br>In Information Notice 15/56 ComReg stated that it expects to publish its response to Consultation 14/65 later this year.<br>ComReg observes that a response to Consultation 14/65 remains a work plan action for ComReg, whose timing needs to be considered in light of other work programme priorities and the likely timing of the existing licensee's need for liberalisation in this band. |
| A Spectrum Leasing framework in the RSPP bands | The leasing of rights of use to radio spectrum is provided for as part of the RSPP Decision (Decision 2012/243/EU) and the Common Regulatory Framework for spectrum<br>In the responses submitted to Document 15/70, ComReg observes that many respondents suggested the use of leasing as a mechanism for improving the efficient use of spectrum.<br>ComReg considers that the setting out a spectrum leasing framework for the RSPP bands is a priority action within the 2016 to 2018 timeframe. |

| Developments | Current status and ComReg's observations |
|---|---|
| The EC Digital Single Market Proposal[205] | The EC has begun its public consultations on its digital single market[206]<br><br>ComReg's input into this consultation process will affect its work plan in terms of resourcing and prioritisation of work activities. The specific implications of this development will not be known until the adoption of any subsequent legislation.<br><br>ComReg will continue to contribute to this process and monitor developments noting that its radio spectrum work planning may be impacted by legislative developments in the future. |
| The World Radiocommunication Conference 2015 (WRC-2015) | The WRC-15 was held in November 2015. A wide variety of spectrum matters were discussed at the WRC-15 as per its agenda items[207]<br><br>ComReg supported the development of Ireland's positions in respect of various agenda items concerning specific radio services in the upcoming WRC-15 and/or beyond into the next work programme for the WRC-19<br><br>ComReg is now considering how best to implement the outcomes of the WRC-15 and what effect this might have on ComReg's work planning priorities. |
| Harmonisation of the 2010-2025MHz spectrum band for PMSE | The EC is currently in the process of finalising a harmonisation decision on the 2010-205 MHz band for PMSE.<br><br>Once adopted, this decision will need to be implemented in Ireland |

[205] http://ec.europa.eu/priorities/digital-single-market/docs/dsm-communication_en.pdf

[206] https://ec.europa.eu/digital-agenda/en/news/public-consultation-evaluation-and-review-regulatory-framework-electronic-communications

[207] http://www.itu.int/net/ITU-R/index.asp?category=study-groups&rlink=rcpm-wrc-15-studies&lang=en

# Annex 4: Vodafone letter to ComReg and correspondence

30 November 2015

Mr George Merrigan
Commission for Communication Regulation
Abbey Court
Irish Life Centre
Lower Abbey St
Dublin 1

**RE: Vodafone views on spectrum strategy**

Dear George,

Vodafone are writing to confirm our consultation responses to recent consultations on spectrum strategy. Vodafone are concerned that our views are being misinterpreted to support a view that Vodafone's first preference in terms of spectrum priorities is an assignment of 2.6GHz and 700MHz in one award and a support for the view that 3.6GHz spectrum is the first priority.

It should be noted that Vodafone was led to believe that ComReg had prioritised 2.6GHz as a spectrum band for earlier release given the availability of the spectrum from April 2016 which was a year before licenses expired on 3.6GHz spectrum. ComReg's consultation was '2.6GHz auction with possible inclusion of 700MHz and other bands'. Document 14/102 would also suggest that it was ComReg's view that 2.6GHz should be prioritised. In fact ComReg's advisors , DotEcon, confirmed in their report supporting the consultation that they had already started the process:

'Existing licences for radio spectrum in the 2.6GHz band expire in April 2016 and ComReg has commenced the process for awarding rights of use for frequencies in this band after this date. ComReg has engaged DotEcon to provide support in the design and implementation of the award process. In this report we discuss a number of key issues for the design of an award process for assigning rights of use for frequencies in the 2.6GHz band, and possibly of additional bands that could be offered in the same award'

Vodafone responded to the consultation on the basis of the strategy being put forward by ComReg. Vodafone argued for a lower number of bands in any auction process and although we expressed an interest in the use of the 700MHz band we pointed out the likely delay in getting this spectrum freed. We identified that we did not want 2.6GHz auction delayed significantly by this move. This is what appears to be the case. Our clear ask was to reduce the number of bands and simplify any future auctions.

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ComReg's decision to prioritise 3.6GHz band was therefore not based on the assumptions in document 14/102. For the avoidance of doubt in its response to document 14/10, Vodafone stated:

**'Vodafone would favour an auction design with a lower number of bands being simultaneously auctioned. An additional auction, or auctions, at a planned later date could award the other bands. The extra overhead imposed on Comreg and Operators by holding additional award processes would be compensated for by having significantly more simple auctions at more predictable times. We would ask that Comreg publish a work programme for future auctions setting out a quarter by quarter program over the next number of years. This would help operators plan resources and approvals and give more regulatory certainty to the market.'**

**'The early release of this spectrum from DTT to mobile applications is certainly of interest and we continue to support the process underway with the Cost-benefit analysis referred to in p3.44....While these processes are useful the timing of completion of a possible reallocation of spectrum from DTT to mobiles remains uncertain. The conclusion and implementation of an agreement with broadcasters on a move of DTT spectrum allocation in Ireland may take considerable time'.**

**'The long term attractiveness of the 700MHz for nationwide coverage is agreed...The key issues will be around the timing of availably of the spectrum and whether the uncertainty in the timescales required to agree a required move of DTT services could delay a 2.6GHz award process...The benefit of adding this band to the award process needs to be balanced with the possible delays to an auction'.**

Vodafone would ask that any auction in 2016 would take the opportunity to auction a number of bands not just 3.6GHz. Vodafone would argue it is inefficient use of spectrum if the 2.6GHz spectrum band remains unassigned when there is clear demand and to await the release of 700MHz could result in no assignment of 2.6GHz until 2017, at the earliest. The spectrum imbalance which exists at the moment creates a competitive disadvantage for Vodafone and the longer the imbalance exists the more potential damage exists for Vodafone. It is Vodafone's view that there is no impediment to ComReg conducting an award process for 2.6GHz spectrum in 2016.

We would welcome your views on the comments above.

Sincerely,

_____

**Gary Healy**

**Head of Regulation & External Affairs**
**Vodafone Ireland Limited**

Commission for
**Communications Regulation**
Coimisiún Um
**Rialáil Cumarsáide**

**4 December 2015**

Mr Gary Healy
Head of Regulation & External Affairs
Vodafone Ireland Limited
MountainView,
Leopardstown Dublin 18

**Re: Vodafone views on spectrum strategy**

Dear Gary,

I refer to your letter of 30 November 2015 to George Merrigan, in which Vodafone sets out its views on spectrum strategy.

I firstly note Vodafone's concern that its "*views are being misinterpreted to support a view that Vodafone's first preference in terms of spectrum priorities is an assignment of 2.6GHz and 700MHz in one award and a support for the view that 3.6GHz spectrum is the first priority*", and its reference to its submission to ComReg Document 14/101 in this connection.

Having considered the relevant documents issued by ComReg subsequent to the publication of Document 14/101 (namely, Information Notice 15/14 and Consultation 15/70), I am unaware of any circumstance in which Vodafone's submission to Document 14/101 was considered in said documents in such a manner so as to support Vodafone's concern as expressed in your letter. See, for example, paragraph 6 of Information Notice 15/14 and section 3.2.1 of Consultation 15/70.

I also note Vodafone's request that "*any auction in 2016 would take the opportunity to auction a number of bands and not just the 3.6 GHz band*" and its view that *"there is no impediment to ComReg conducting an award process for 2.6GHz spectrum in 2016*." I observe that such matters are relevant to ComReg's spectrum management strategy consultation, which is intended to be issued shortly. ComReg is therefore treating your letter as an input to this forthcoming consultation, and Vodafone's views (including any subsequent views Vodafone may wish to submit) will be considered alongside submissions received from other interested parties on same.

As with other submissions received in connection to ComReg consultations, we intend to publish a non-confidential version of your letter on ComReg's website in

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due course. In that regard, I note that your letter is not marked as confidential. However, should Vodafone consider any material to be genuinely confidential, then I would request that any representations to that effect be provided in accordance with the procedures set out in ComReg Document 05/24 and by 1pm on Friday 11 December 2015. ComReg also intends to publish this response in due course.

Yours sincerely,

Kevin Kennedy

Kevin Kennedy
Senior Manager Spectrum Policy and Development