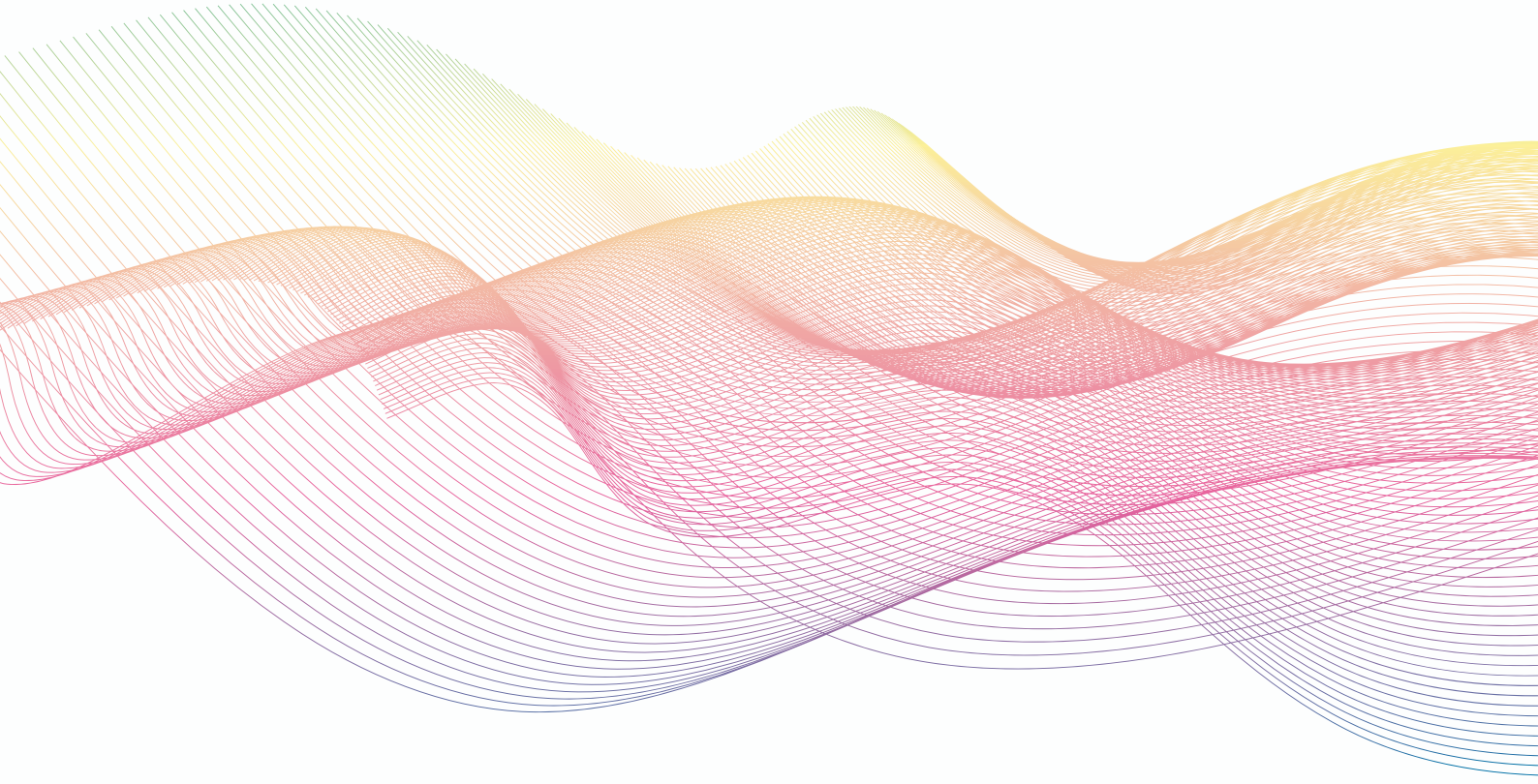
Radio Spectrum Management Strategy Statement
2019 to 2021



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Commission for
Communications Regulation
An Coimisiún um
Rialáil Cumarsáide

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Foreword

This strategy statement sets out ComReg's work plan and priorities for the next two years in relation to its role as Ireland's spectrum manager and complements ComReg's Electronic Communications Strategy Statement.

I am pleased to present the Commission for Communications Regulation's *Radio Spectrum Management Strategy Statement for Ireland* for the period 2019 to 2021.

Radio frequencies are used to provide a wide range of electronic communications services and applications for the benefit of society. Citizens use radio frequencies when they make a mobile phone call or use mobile data, when they listen to the radio or watch broadcast TV, and when they use a contactless card to make a payment or enter a building. Radio frequencies are used to keep planes flying safely, to ensure smooth operations by our defence forces and public safety services, and to support many private businesses.

The wireless telecommunications sector plays an important role in the Irish economy and accounts for around 17,000 full time equivalent jobs, €4 billion Gross Value Added and an estimated total contribution of spectrum-dependant activities of €6.2 billion – amounting to 3.5% of Irish Gross National Income.

Communications services need clear channels in order to carry out their operations. For uses connected to public safety, this can be critical to protecting property, health and human life. ComReg acts within our legislative framework and within the resources available to us in order to make spectrum available, free of interference and in a properly managed manner.

There is a fast pace of technological change affecting the way radio spectrum is used. Hand-held devices and tablets have become the main way that people access communications services and on-line applications. The connectivity that supports them includes both WiFi access to fixed networks as well as mobile broadband. There are increased expectations for connectivity – and the need for more capacity, faster speeds and wider availability of connectivity looks set to continue.

We can also foresee new uses that require new forms of connectivity. 5G and other wireless technologies will not only enable enhanced mobile broadband services, they will also enable applications that connect massive numbers of devices for machine-to-machine communications, and applications that require ultra-reliable service levels that cannot be guaranteed with today's technology. Examples of applications that have been suggested include connected self-driving vehicles, smart agriculture, smart manufacturing and telemedicine.

Over the past several years, ComReg has licensed a considerable amount of spectrum. This has enabled explosive growth in the use of mobile broadband services. We were also among the first in the EU to license the 5G pioneer band at 3.6 GHz. In the forthcoming period, ComReg will further develop and finalise its multi-band award proposals for the release of spectrum rights for the provision of wireless broadband (both mobile and fixed broadband) services.[1]

This spectrum management strategy statement is an important tool for ensuring the efficient use of spectrum. The consultation process was an opportunity for stakeholders to help shape our priorities, particularly about the timing of future assignment processes for different bands. We received many responses – for which we are grateful – and have carefully considered them in finalising our strategy.

This strategy statement sets out ComReg's work plan and priorities for the next two years in relation to its role as Ireland's spectrum manager and complements ComReg's Electronic Communications Strategy Statement.[2]

I look forward to the challenges we will face over the next two years as ComReg strives to deliver on the objectives outlined in this statement.

Commissioner Jeremy Godfrey

1 See ComReg Document 18/60, which proposed an award of spectrum rights in the 700 MHz Duplex, Paired 2.1 GHz, 2.3 GHz and 2.6 GHz frequency bands.

2 ComReg's Electronic Communications Strategy Statement 2017–2019 – **https://www.comreg.ie/publication/electronic-communications-strategy-statement-2017-2019/**

Introduction

2

Radio spectrum is a medium by which information may be transmitted wirelessly over distances ranging from a few metres to thousands of kilometres. It is a valuable national resource underpinning important economic, social and communications activities.

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 Ireland's radio frequency spectrum ("radio spectrum" or "spectrum") and national numbering resource.

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. It 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. Radio spectrum is also 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. However, it is a finite natural resource with competing uses and users and so it must be managed effectively and efficiently used.

2.3 To assist ComReg's management of the radio spectrum, ComReg regularly sets out and updates its strategy for same[3] and is also reflective of ComReg's strategic intents as set out in its 5 year Electronic Communications Strategy Statement.[4] ComReg's draft radio spectrum management plan for 2019 to 2021 is set out in ComReg Document 18/74[5] ("Consultation 18/74") and ComReg's consideration of the responses received from interested parties to that consultation is set out in ComReg Document 18/117.[6]

2.4 Published alongside this document is a report from Frontier Economics ("Frontier") that estimates the contribution that radio spectrum makes to the Irish economy. The report is entitled "The Economic Contribution of Radio Spectrum to Ireland" (Document 18/118a) ("Frontier Report").

2.5 This document sets out ComReg's final radio spectrum management strategy statement and work plan for the period 2019 to 2021.

3 In accordance with ComReg's obligations under section 31 of the Communications Regulation Act 2002 (as amended) ("2002 Act").

4 https://www.comreg.ie/publication/electronic-communications-strategy-statement-2017-2019-design-version/

5 ComReg Document 18/74 – https://www.comreg.ie/publication/proposed-strategy-for-managing-the-radio-spectrum-2019-2021/

6 ComReg Document 18/117 – available at ComReg.ie

Factors informing ComReg's draft radio spectrum management strategy statement

The spectrum management work plan for 2019 to 2021

2.6 ComReg manages its workload in a manner that attempts to appropriately and pragmatically address the needs of a diverse range of actual and potential spectrum users. In that regard, ComReg balances the numerous considerations to establish a prioritised work plan commensurate with its resources, including:

- the capacity within the existing radio spectrum bands to meet spectrum needs. Where capacity exists, it may be possible to meet this demand via the existing spectrum assignments or to award new assignments using existing authorisation processes;
- 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 spectrum bands;
- the international harmonisation status of a spectrum band including any future harmonisation plans;
- the harmonisation status and appropriate timing for release of spectrum bands that are currently unassigned;
- the potential to remove certain restrictions (or "liberalise") currently placed on licences which may enable more 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 where appropriate to achieve ComReg's statutory objectives and duties;
- the adoption of legislation (national or European) which requires ComReg to take defined actions within a set timeframe;
- the potential for market mechanisms to address spectrum management issues;[7] and
- other relevant considerations that may arise.

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

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

2.7 The spectrum work plan for 2019 to 2021 outlines the spectrum activities that ComReg intends to carry out within this timeframe and includes:

- advancement of its proposed multi-band award of spectrum rights for the provision of wireless broadband (both mobile and fixed broadband) services;
- assisting the Department of Communications, Climate Action and Environment ("DCCAE"), RTÉ and 2rn as appropriate in facilitating the migration of digital terrestrial television ("DTT") services from the 700 MHz band by 4 March 2020;
- assisting the DCCAE in the transposition of the European Electronic Communications Code ("EECC"), and implementing same as appropriate; and
- promoting Test and Trial Ireland and the benefits of using Ireland as a location to test or trial wireless products and services in a real world environment.

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

2.2 Structure of this document

2.9 The remainder of 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;
- **Chapter 4:** considers the factors informing ComReg's strategy for the period 2019 – 2021;
- **Chapter 5:** sets out ComReg's Radio Spectrum work plan for the period 2019 – 2021; and
- **Annexes:**
  - **Annex 1:** Summary of ComReg's statutory framework relevant to the management of the radio frequency spectrum in Ireland;
  - **Annex 2:** Spectrum designators.

The Framework for Spectrum Management in Ireland

3.1 Spectrum Policy and Management in Ireland

3.1.1 Spectrum Policy

3.1 A key role of the DCCAE is the development of policies for the regulation and optimal use of Ireland's radio spectrum. Spectrum policy is part of the national policy governing the telecommunications sector in Ireland, which also covers next generation broadband, electronic communications services ("ECS") and international connectivity. The DCCAE also has the responsibility for developing national broadcasting policy and associated spectrum use.

3.1.2 Spectrum Management: ComReg's mandate and role

3.2 The Communications Regulation Act 2002 (as amended) (the "2002 Act"), the European Common Regulatory Framework for electronic communications networks ("ECN") and ECS (including the Framework and Authorisation Directives[9] as transposed into Irish law by the corresponding Framework and Authorisation Regulations[10]), and the Wireless Telegraphy Act 1926 (as amended)[11] (the "1926 Act") set out, among other things, functions, objectives, powers and duties that are relevant to ComReg's management of the radio spectrum.

3.3 In exercising its function of the management of Ireland's radio spectrum (and in accordance with relevant ministerial Policy Directions given under section 13 of the 2002 Act), ComReg's primary spectrum management 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.

3.4 In the context of radio spectrum used for ECN/ECS, one of ComReg's primary objectives is to promote and create the conditions for effective competition in the provision of ECN and ECS. In that regard, 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 there is no distortion or restriction of competition in the electronic communications sector;
- encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources; and
- ensuring that users, including disabled users, derive maximum benefit in terms of choice, price and quality.

3.5 Readers are referred to Annex 1 for an overview of the legal framework and statutory objectives relevant to ComReg's management of the radio spectrum. ComReg, in preparing the strategy set out herein, has also had regard to the European Electronic Communications Code, a new EU Directive published in the EU Official Journal on 17 December 2018 and entering into force on 20 December 2018, from which date each Member State has two years to complete its transposition into national law.

3.6 ComReg recognises that the current European Common Regulatory Framework for ECN and ECS will be superseded by the EECC during the course of this forthcoming strategy period. Among other things, the ECCC will consolidate, update and replace the various directives under the existing framework (i.e. the Framework, Authorisation, Access and Universal Service directives).

9 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"). Noting that these directives are being replaced by the EECC.

10 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"). Noting that these regulations will be replaced by the Irish legislation that will transpose the EECC.

11 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.

It is estimated that the economic contribution of the radio spectrum to Ireland is a Gross Value Added of €4 billion and around €6.2 billion contribution to Irish Gross National Income

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

- licensing of spectrum rights of use 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.

3.8 Further details of these activities are set out in Chapter 4.

3.2 Spectrum Management

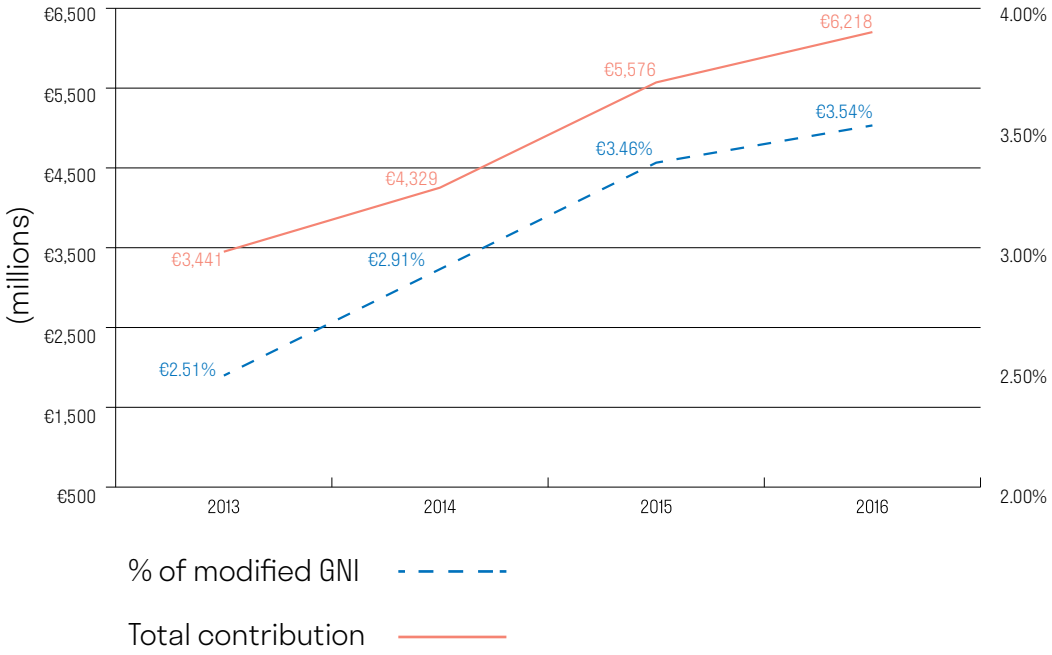
3.9 The radio spectrum is a limited and valuable national resource that permeates all areas of communications, including radio, television, mobile voice and data, aeronautical/marine navigation, and satellite communications. Increased demand for the radio spectrum requires that it be used efficiently and that effective spectrum management processes be employed to maximise the benefits to society.

3.10 The ability to take full advantage of the spectrum resource depends on the spectrum management activities that facilitates the implementation of radio systems with minimum radio interference.[12] However, as spectrum is a finite resource with many different actual and potential services and users, 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 efficiently used. This may also involve balancing a range of competing factors, including:

- appropriately meeting the reasonable requirements of all radio services, including commercial and public uses, the latter including public safety, national security and health care; and

12 The radio spectrum needs be managed because two or more radio signals occurring simultaneously and in the same location can interfere with each other reducing the ability of the radio spectrum to operate effectively. It is not possible for users to share spectrum indiscriminately because one user may cause interference for another user.

Figure 1:
Contribution of Radio Spectrum to GNI: 2013 – 2016



- 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.

3.11 A system of spectrum management is required to ensure the efficient assignment and subsequent use of scarce frequencies among competing uses and users. This should promote competition within the relevant downstream markets, particularly given that spectrum is an essential input in the provision of many ECS and an inefficient assignment of spectrum has the potential to distort/restrict competition and create inefficient outcomes for society.

3.2.1 The importance of the radio spectrum

3.12 Frontier Economics ('Frontier') was commissioned by ComReg to estimate the economic contribution of radio spectrum to Ireland. This analysis, which is based on company financial records and data from the national accounts, conservatively estimates Gross Value Added ("GVA") of €4 billion and around €6.2 billion contribution to Irish Gross National Income ("GNI")[13] or approximately 3.5% of GNI*.

3.13 Figure 1 illustrates the relationship between Ireland's GNI in years 2013 to 2016 with the aggregate estimated economic contribution from the use of radio spectrum over the same period. It highlights that the contribution of radio spectrum increased from €3.4bn in 2013 to €6.2bn in 2016, accounting for around 3.5% of GNI, when modest multiplier effects are taken into account.[14]

3.14 Radio spectrum is also an important contributor to employment. A conservative estimate of the number of employees in Ireland whose jobs are directly dependent on the use of radio spectrum was around 17,000 (FTE) for 2016.

13 A significant part of the income arising from the production of goods and services in Ireland accrues to the foreign owners of capital assets based in Ireland. Hence, the GDP aggregate overstates the living standards of Irish residents Modified GNI is an indicator that was recommended by the Economic Statistics Review Group and is designed to exclude globalisation effects that are disproportionally impacting the measurement of the size of the Irish economy.

14 In 2016, €4 billion is the direct contribution, €1.3 billion is indirect with the remaining €0.98 million accruing from taxes and subsidies.

Figure 2:

The wireless day: how we use spectrum throughout the day

07:00

Wake up, use the home Wi-Fi Network on mobile and laptop devices.

09:00

Drive to work: use a car wireless “key” to unlock and deactivate the car alarm, or use the remote control to open the garage

12:00

Lunchtime shopping: pay by tapping cash card or mobile handset with Near Field Communication (NFC)

17:00

The drive home: navigation on a mobile handset enabled by GPS

19:00

Evening at home: remote control for TV Bluetooth speakers and other accessories around the home

00:00

At night: baby alarms and other household sensors

Social and secondary benefits of spectrum usage

3.15 There are also considerable social benefits 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.

3.16 Access to sufficient spectrum is necessary in facilitating free-to-air television and radio broadcasting by the public service and independent broadcasters. Effective free-to-air delivery of national and regional broadcast schedules helps ensures media plurality, a greater expression of national and community cultural identity and the development of home-grown audio-visual content, including drama and documentaries. Radio spectrum also enables the use of a wide variety of consumer applications improving the daily lives of citizens.

3.17 Business applications are also likely to be enabled through the use of the radio spectrum across a variety of sectors, including:

- utilities – which uses wireless technologies to properly monitor and measure activity, and provide security in a widely distributed set of network assets. In the future, Smart Grids will connect many more devices and equipment to electricity networks;
- agriculture – which uses wireless applications to measure various aspects of animal husbandry and arable farming to improve yield and reduce costs; and
- logistics – which uses wireless technologies to enable more efficient supply chains and enhanced customer value.

Productivity enhancements

3.18 The use of radio spectrum, through its ability to facilitate the deployment of new technologies and innovation, also positively contributes to improvements in productivity.[15] Investment in ICT capital used in the Irish economy as a result of spectrum is likely to contribute to productivity growth across a range of sectors and lead to additional growth across the economy. Frontier conservatively estimate that spectrum-related ICT investments have enhanced productivity by around €0.5 billion in 2016 (see Chapter 3 of Frontier Report – Document 18/118a).

3.2.2 Spectrum management processes

International aspects to spectrum management

3.19 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 frequency bands used by TV and radio broadcasting services 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.

15 Frontier define productivity (Total Factor Productivity) as the output produced in an economy for a given set of inputs used in production (capital and labour).

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"

3.20 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 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 for 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.

3.21 As the radio spectrum manager for Ireland, ComReg is charged with the implementation of international treaties and obligations relating to the use of radio spectrum in the State.[16] The implementation of these measures often requires actions in relation to the allocation and/or assignment of radio spectrum as discussed below.

3.22 Along with the DCCAE, 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 radio spectrum.

16 The interference-free operation of radio-communication 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 Radio-communication Conferences. The Radio Regulations (RRs), which have the status of an international inter-governmental 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 Radio-communication 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 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

The "assignment" of radio spectrum refers to the spectrum management activities that issues, and authorises the use of, rights of use of radio frequencies.

The allocation of radio spectrum in Ireland

3.23 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".[17] 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.

3.24 Under the 2002 Act, ComReg is obliged to publish a Radio Frequency Plan ("Plan"). The Plan is comprised of a set of tables which sets out Ireland's radio spectrum allocations for 8.3 kilohertz to 3000 Gigahertz, indicating the services to which each frequency band is allocated ("frequency allocations") in the radio spectrum and is an essential tool for current and future users of radio frequencies.

3.25 The Plan is updated regularly in line with the outcomes of the ITU World Radiocommunication Conferences ("WRCs") and other relevant developments, such as the adoption of European harmonisation decisions and recommendations for a particular radio frequency band or service. The current version was published in May 2017[18] and a comprehensive update is anticipated following the ITU WRC in 2019 (see Chapter 4 for further details on WRC-19).

The assignment of radio spectrum in Ireland

3.26 The **"assignment"** of radio spectrum refers to the spectrum management activities that issues, and authorises the use of, rights of use of radio frequencies.[19] In Ireland, the possession and use of radio equipment requires authorisation from ComReg and this authorisation may take the form of a licence or a licence-exemption under the 1926 Act.

3.27 Ideally, spectrum should be distributed efficiently, which means giving access to the combination of uses and users that maximises economic activity, subject to taking account of social welfare, public and other legitimate policy concerns. Granting spectrum rights of use to one user rather than another can greatly impact the extent to which the radio spectrum is efficiently used to deliver overall benefits for society.

17 European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. 333 of 2011).

18 ComReg Document 17/34 - Radio Frequency Plan for Ireland – published 3 May 2017.

19 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).

3.2.3 Promotion of effective competition in management of spectrum for ECS and spectrum management tools

3.28 As noted above, spectrum is an essential input in the provision of ECS and inefficient assignments of spectrum rights has the potential to distort competition and create inefficient outcomes for society.

3.29 These issues are reflected in ComReg's Electronic Communications Strategy Statement[20] where the following three principle methods are identified by which to promote competition and consumer choice:

1. market access;
2. access to essential inputs; and
3. demand-side factors.

3.30 In relation to the second principle (i.e. access to essential inputs), ComReg outlined its strategy to ensure that the management of the national spectrum (and numbering) resources take account of the promotion of competition, and the potential impact that the assignment and allocation of these inputs may have on downstream markets.[21] This principle also informs Goal 5 of the Electronic Communications Strategy Statement, which requires ComReg to take all reasonable measures which are aimed at the promotion of competition.

GOAL 5

Spectrum management for electronic communications markets takes account, inter alia, of the promotion of competition.

Source: *Electronic Communications Strategy Statement 2017–2019*

3.31 Goal 5 in turn reflects one of ComReg's primary objectives in respect of ECN and ECS being the promotion of competition. The promotion of competition is a primary goal of ComReg's spectrum management function because effective competition between wireless service providers brings long term benefits to consumers in terms of price, choice, quality of services and innovation. The efficient assignment and use of the radio spectrum is therefore an important consideration in promoting effective competition.[22]

3.32 In that regard, ComReg takes a proactive approach to ensuring the efficient assignment and use of the radio spectrum while promoting effective competition and producing an optimal outcome for society. ComReg has a number of spectrum management tools that are designed to serve the interests of all users of the radio frequency spectrum and strike the right balance between those users while ensuring that spectrum is used efficiently and competition is not distorted. ComReg uses these tools as required, depending on the circumstances of each particular assignment, in order to derive the maximum benefit for society and contribute to the development of the internal market, while promoting the interests of users within the Community. These tools are illustrated in Figure 3.

3.33 The use of these tools 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 efficiently assigned and used. Any measures must also be objectively justified, transparent, non-discriminatory and proportionate in relation to their intended purpose. The use of such spectrum management tools often requires detailed consideration with relevant stakeholders.[23]

20 ComReg Electronic Communications Strategy Statement 2017-2019: https://www.comreg.ie/publication/electronic-communications-strategy-statement-2017-2019-design-version/

21 ComReg's Electronic Communications Strategy Statement 2017-2019 – p10.

22 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.

23 See Goal 24 Electronic Communications Strategy Statement below. "We are proactive on engagement with a range of stakeholders."

Figure 3:

Spectrum Management Tools

Spectrum management can facilitate investment by fostering regulatory certainty and ensuring the availability of the necessary inputs by effectively managing the radio spectrum.

3.34 In its Electronic Communications Strategy Statement, ComReg also noted, among other things that:

- Creating the conditions for investment is as much about regulatory certainty as it is about shaping operator incentives;
- It will continue to publish its forward-looking strategy for managing the radio spectrum; and
- It publishes information on existing licensees' spectrum assignments and related information and usage because, among other things, this can increase the efficient use of spectrum by better informing consumers and other interested parties (such as actual and potential spectrum users).

3.35 In relation to the first bullet, spectrum management can facilitate investment by fostering regulatory certainty and ensuring the availability of the necessary inputs by effectively managing the radio spectrum. In that regard, effective competition is the principal driver of efficient investment and as such ComReg seeks to create the conditions for investment primarily by promoting competition. This is in line with Goal 15 and ComReg's 'Third Strategic Intention'.[24]

GOAL 15

The management of spectrum and numbers facilitates efficient investment.

Source: Electronic Communications Strategy Statement 2017–2019

3.36 In relation to bullets 2 and 3, the Radio Spectrum Management Strategy Statement is an important spectrum management tool of itself as it provides interested parties with visibility of future planned releases of spectrum, which allows them in turn to plan for their spectrum needs. It also allows ComReg to take due account of the timing of each spectrum award. The assignment of harmonised bands, such as those suitable for widespread coverage,[25] provides opportunities for promoting new entry and competition. Given that rights of use for important bands are typically assigned for long periods (e.g. 15 years, or potentially 20 years as identified in the EECC), the timing of spectrum awards should be such that opportunities for promoting new entry and effective competition are maximised (e.g. ensuring that a mix of complementary and/or substitutable spectrum across different bands are available at different intervals).

24 See Strategic Intention 3 Electronic Communications Strategy Statement "Efficient investment has enabled affordable, high quality and widespread access to communications services and applications"

25 For example: the 700 MHz, 800 MHz or 900 MHz bands.

Modern environmentally friendly building materials reduces in-door mobile coverage

Modern insulation means that heat is kept in and houses are insulated from the cold...

However, these materials also prevent radio waves from penetrating.

3.37 ComReg is also conscious of the need to respond to changing circumstances which could undermine efficiency and innovation and, in that regard, continues to monitor the market in order to learn from users' ongoing experience and adapt to changes in, among other things, technologies, and demand for services from spectrum users and end-users, market developments and relevant public policy.

Consumer information and market monitoring

3.38 As part of its spectrum management function, ComReg also monitors the changes to the market since its previous radio spectrum management strategy statements and spectrum awards. ComReg is conscious that the circumstances previously present may have changed or the market has developed such that the spectrum management tools referred to above may need to be deployed differently to promote competition and protect consumers. This approach is in line with Goal 8 of the Electronic Communications Strategy Statement.

GOAL 8

ComReg understands evolving consumer needs, preferences, behaviours and perceptions.

Source: Electronic Communications Strategy Statement 2017 – 2019

3.39 In that regard, ComReg continually tracks end-user usage trends (see ComReg Quarterly Reports) and has completed various market research and forecasting in order to inform future spectrum management activities. For example:

- B&A Mobile Consumer Experience Survey (See Documents 17/100 and 17/100a);
- 2017 Ireland Communicates Survey of ICT usage by consumers (Document 18/23a);
- 2017 Ireland Communicates Survey of ICT usage by SMEs (Document 18/23b); and
- Mobile data usage forecasts (Document 18/35 and 18/35a).

3.40 For example, the following factors have particularly important spectrum management implications:

- Total annual mobile data traffic is forecast to increase by over 3.5 times between 2017–2022[26];
- The Mobile Consumer Experience Survey highlighted a number of key issues and concerns with regard to mobile connectivity including:
  - inside the home is where consumers mostly use their mobile phone for voice and data services[27];
  - incidence of experiencing service issues in the house for calls/text and data (c. 30%) is higher than the same service issues that occur outside the home[28];
  - rural consumers have higher rates of experiencing service issues regardless of location with higher levels of service issues arising in the home (i.e. indoor)[29];
- The ICT survey highlighted that making and receiving calls domestically remains the most important use of mobile telephony.

3.41 In response to the information received, ComReg initiated the following work streams with a view to informing future spectrum award proposals, providing additional consumer information and improving the connectivity experience for consumers:

- Progressing its proposals for the release of spectrum rights for the provision of wireless broadband (both mobile and fixed broadband) services;[31]
- a *Future Mobile Connectivity in Ireland* ("FMC") study to obtain advice on mobile connectivity services and the potential costs of providing same;[32]

26 ComReg Document 18/35 – Mobile Data Traffic Forecast in Ireland

27 ComReg Document 17/100a - Ireland Communicates Survey 2017 – Consumer - slides 43 & 46.

28 ComReg Document 18/32a - Ireland Communicates Survey 2017 – Consumer - slide 51.

29 ComReg Document 18/32a - Ireland Communicates Survey 2017 – Consumer - slides 54 & 56.

30 ComReg Document 18/32a - Ireland Communicates Survey 2017 – Consumer - slide 32.

31 ComReg Document 18/60 – Proposed multi band spectrum award - preliminary consultation on which bands to award.

32 ComReg Document 18/103c - https://www.comreg.ie/publication/future-mobile-connectivity-in-ireland/

- *"Meeting Consumer's Connectivity Needs"* – a report for ComReg that provides an overview of the challenges in providing connectivity in Ireland and the actions that all stakeholders can take to optimise their levels of connectivity which are available on different networks across Ireland;[33]

- *"Coverage obligations and Spectrum Awards"* – a report for ComReg that considers how and the extent to which coverage and rollout obligations can be included in future spectrum awards;[34]

- Effect of Building Materials on Indoor Mobile Performance: determining and reporting upon the extent to which some representative modern building materials impact on in-building coverage by measuring overall attenuation through each building material tested;[35]

- Bi-Annual Drive Testing - Assessment of Mobile Network Operators' Compliance with Licence Obligations (Coverage);[36]

- Mobile Handset Performance: measuring and reporting on the antenna performance of mobile handsets available on the Irish market in order to quantify the performance of each handset when making or receiving a mobile call and to stream data. See:

  - Voice (Document 18/05 and 18/78)[37]

  - Data (Document 18/82)[38]; and

- Mobile Coverage Prediction Map - a solution to provide consumers with a visual (geographic-based) means of presenting predicted mobile coverage throughout Ireland, through the use of an interactive website.

3.42 This approach is also in line with Goal 17 of the Electronic Communications Strategy Statement. In particular, the FMC study and the Coverage Obligations and Spectrum Awards Report will be used by ComReg to inform its considerations regarding the appropriate coverage obligations that should be attached to, among other things, 700 MHz rights of use.

GOAL 17

Mobile coverage obligations are used to promote investment where proportionate.

Source: Electronic Communications Strategy Statement 2017–2019

3.43 In providing for same, ComReg recognises the need to communicate with different stakeholder groups and interested parties. This engagement takes a number of forms, including formal consultation[39] and publication of proposals on the ComReg website, and is in line with Goal 24 of the Electronic Communications Strategy Statement.

GOAL 24

We are proactive on engagement with a range of stakeholders.

Source: Electronic Communications Strategy Statement 2017–2019

3.44 ComReg will publish the output from each work stream and the information contained therein will be used to inform ComReg's spectrum management activities across a range of projects in order to promote the best outcomes for society.

33 ComReg Document 18/103b - https://www.comreg.ie/publication/meeting-consumers-connectivity-needs/

34 ComReg Document 18/103d - https://www.comreg.ie/publication/coverage-obligations-and-spectrum-awards/

35 ComReg Document 18/73 – The effect of building material on indoor mobile performance.

36 ComReg Document 18/26 – Assessment of mobile network operators' compliance with licence obligations (coverage) winter 2017.

37 ComReg Documents 18/05 and 18/78 - Mobile Handset Performance (Voice) & The Effect of Building Materials on Indoor Mobile Performance.

38 ComReg Document 18/82 - Mobile Handset Performance (Data)

39 ComReg Document 11/34 - *Consultation Procedures*.

Factors informing ComReg's work plan for 2019 – 2021

4.1 A wide range of factors influence 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.

4.2 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.

4.3 In this chapter, ComReg discusses various factors which have informed its radio spectrum work plan for 2019 to 2021, including:

- International harmonisation of radio spectrum;
- World Radiocommunication Conference of 2019;
- European Commission harmonisation decisions;
- End-user demand (and, in particular, for mobile broadband);
- Technology changes and advancements (service specific); and
- The expiry of existing licences in the near future (e.g. within the next 5 years).

4.1 International harmonisation of radio spectrum

4.4 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.

4.5 International harmonisation, and the benefits 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.

4.6 In ComReg's experience, the appropriate release of harmonised spectrum bands has proven to be generally very successful in facilitating the delivery of services to end-users.[40]

4.7 Harmonised radio spectrum measures are implemented by a number of bodies including the ITU (and/or the constituent regional groups), the CEPT and relevant 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[41] and RSPG.[42] In some

40 In Ireland, harmonised spectrum bands support a wide range of services, include those provided by mobile operators.

41 For example, the ECC CEPT work plan for 2018 to 2020 identifies the following major topics:

- Assess the feasibility of M2M/IoT through satellite from a technical and regulatory point of view;
- Spectrum for wireless broadband (including 5G); and
- The use of MFCN for UAS.

42 The draft RSPG work programme for 2018 and beyond includes the following work items:

- EECC;
- RSPG structure and working methods;
- Peer review and Member State cooperation on authorisation and awards;
- 5G Implementation Challenges;
- Common Policy objectives for WRC-19;
- "Good offices" to assist in bilateral negotiations between EU countries; and
- European Spectrum Strategy.

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.

instances, harmonisation decisions are obligatory on Member States thereby directly increasing the supply of spectrum at a national level with a defined timeframe.[43]

4.8 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.

4.1.1 The World Radiocommunication Conference of 2019

4.9 Led by the DCCAE, Irish preparations for World Radiocommunications Conference 2019 ("WRC-19") are underway. ComReg is involved in this work and will assist the DCCAE to meet objectives and goals that will be established in the national preparatory process.

4.10 The major agenda items of interest to Ireland at WRC-19 are expected to be:

- Broadband applications in the Mobile Services - I. The following bands, which are already allocated to Mobile Services are being studied with a view to an IMT-2020 identification:

  a) 24.25 - 27.5 GHz;
  b) 37 - 40.5 GHz;
  c) 42.5 - 43.5 GHz;
  d) 45.5 - 47 GHz;
  e) 47.2 - 50.2 GHz;
  f) 50.4 - 52.6 GHz;
  g) 66 - 76 GHz; and
  h) 81 - 86 GHz;

- Broadband applications in the Mobile Services – II. The following bands will also be studied, although they do not currently have global mobile allocations:

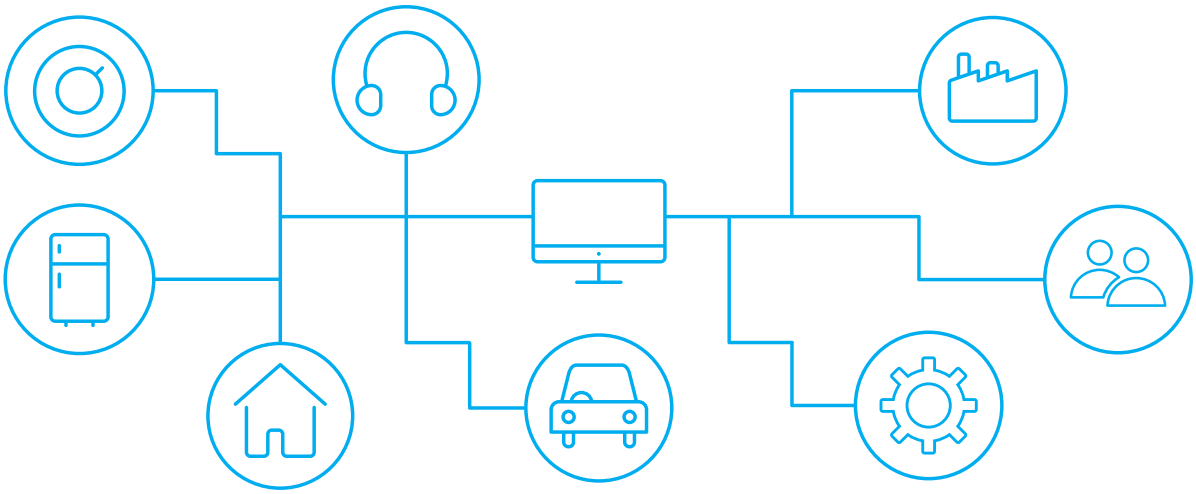
  a) 31.8 - 33.4 GHz;
  b) 40.5 - 42.5 GHz; and
  c) 47 - 47.2 GHz;

- To take appropriate regulatory actions (which include additional Mobile Service allocations) for Wireless Access Services / Radio LANs in the bands between 5 150 - 5 925 MHz;

- Studies to consider possible global or regional harmonised bands, to the maximum extent possible,

43 In Europe, EU/EC decisions are obligatory on Member States, while CEPT decisions are non-binding and voluntarily adopted by its members.

M2M Cellular IoT Technologies



for implementation of evolving Intelligent Transport Systems ("ITS") within existing Mobile Service allocations;

- To consider possible regulatory actions to support Global Maritime Distress and Safety Systems ("GMDSS") modernisation and the introduction of additional satellite systems into GMDSS;
- Studies to consider regulatory actions within the band 156 - 162.05 MHz for autonomous maritime radio devices to protect GMDSS and Automatic Identification System ("AIS");
- To consider new Maritime-Mobile Satellite Service (MMSS E-s and s-E) allocations, preferably within 156.0125 - 157.4375 MHz and 160.6125-162.0375 MHz to enable a new VHF data exchange system ("VDES") satellite component;
- Studies to consider the spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System ("GADSS");
- To consider the use of the bands 17.7-19.7 GHz (s-E) and 27.5 29.5 GHz (E-s) by earth stations in motion communicating with GSO space stations in the FSS and take appropriate action; and
- Studies on development of a regulatory framework for non-GSO FSS systems that may operate in the bands 37.5-39.5 GHz (s-E), 39.5-42.5 GHz (s-E), 47.2-50.2 GHz (E-s) and 50.4-51.4 GHz (E-s).

4.11 The outcome of WRC-19 will influence the future work plans of the relevant bodies of the EC and CEPT and consequently ComReg.

4.2 European Commission harmonisation decisions

4.2.1 Existing EC harmonisation decisions

M2M Cellular IoT Technologies

4.12 Machine to Machine ("M2M") communication and the Internet of Things ("IoT") are widely considered to be applications with significant growth potential. Among M2M/IoT technologies, some are designed to operate in the spectrum bands assigned to MFCN.

4.13 In this regard, ComReg would highlight the following:

- in June 2017, CEPT published ECC Report 266[44] which concluded that certain M2M technologies (i.e. LTE-MTC, LTE-eMTC, EC-GSM-IoT and NB-IoT) can co-exist with the technologies currently deployed in certain frequency bands currently harmonised for MFCN;

44 ECC Report 266 on the Suitability of the current ECC Framework for the usage of Wideband and Narrowband M2M in the frequency bands 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz.

- that pursuant to the findings of ECC Report 266, the Radio Spectrum Committee ("RSC") of the EC is developing an implementing decision to amend Decision 2009/766/EC to enable the deployment of IoT technologies in the 900 MHz and 1800 MHz bands;

- on 20 April 2018, Commission Implementing Decision (EU) 2018/637 was adopted amending Decision 2009/766/EC on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community as regards relevant technical conditions for the IoT;

- the technical conditions for terrestrial systems operating in the 790 – 862 MHz band (as set out in EC Decision 2010/267/EU) stipulate a Block Edge Mask ("BEM") requirement for this band;

- on the basis of the findings of Report 266, that the M2M technologies referred to above can be deployed in the 800 MHz band without a requirement to amend EC Decision 2010/267/EU; and

- that it has granted licences for the provision of ECS in the 800 MHz, 900 MHz and 1800 MHz Bands to eir, Three and Vodafone which are governed by the Wireless Telegraphy (Liberalised Use and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz Bands) Regulations 2012 (S.I. 251 of 2012).

4.14 On the basis of the above, ComReg observes that there would not appear to be impediments to eir, Three and Vodafone deploying the M2M technologies defined in ECC Report 266 in the 800 MHz band. In relation to the 900 MHz and 1800 MHz bands, ComReg has identified the implementation of Decision (EU) 2018/637 as a work plan item for the 2019-2021 strategy period.

700 MHz Band – national flexibility considerations and choices

4.15 The 700 MHz Band (which consists of 96 MHz of spectrum and spans the frequency range 694 MHz – 790 MHz) is harmonised at three levels within Europe: (i) by the CEPT, (ii) by the EC and (iii) by the European Parliament and Council, as follows:

i. the least restrictive technical conditions ("LRTC") and frequency arrangements for the introduction of MFCN in the 700 MHz Band are harmonised at CEPT level by way of ECC Decision 15(01) of 6 March 2015;

ii. the above LRTC and frequency arrangements are reflected in EC Implementing Decision (EU) 2016/687 of 28 April 2016 ("EC 700 MHz Decision"); and

iii. Decision 2017/899 of the European Parliament and Council of 17 May 2017 on the use of the 470-790 MHz frequency band in the EU ("EU UHF and 700 MHz Band Decision") which:

   a. identifies 30 June 2020 as the date by which Member States shall allow the use of the 700 MHz Band for terrestrial systems capable of providing WBB ECS and only under the harmonised technical conditions set out in the EC 700 MHz Decision identified above; and
   b. provides that, in order to allow the use of the 700 MHz Band in accordance with the above obligation, Member States shall, by 31 December 2017, conclude all necessary cross-border frequency coordination agreements within the Union.

4.16 In light of these harmonisation measures, specific portions within the 700 MHz Band can be identified as follows:

i. "700 MHz Duplex": consisting of the paired frequency range 703–733 MHz and 758–788 MHz;

ii. "700 MHz Duplex Gap": in the frequency range 733–758 MHz; and

iii. "700 MHz Guard Bands"[45] comprising:

45 The use of the term guard bands for these specific portions of the 700 MHz Band does not prevent this spectrum from being assigned and used for WBB in accordance with relevant European harmonisation measures.

a. the "700 MHz Lower Guard Band": in the frequency range 694 – 703 MHz; and
b. the "700 MHz Upper Guard Band": in the frequency range 788 – 791 MHz.[46]

4.17 In that regard, the EC 700 MHz Decision provides Member States considerable flexibility in terms of the different potential uses of these portions, in particular:

i. terrestrial systems capable of providing wireless broadband (WBB) ECS (e.g fixed/mobile wireless broadband);

ii. 'wireless audio PMSE equipment'[47];

iii. 'public protection and disaster relief (PPDR) radio communications'[48]; and

iv. 'machine-to-machine (M2M) radiocommunications'[49].

4.18 The national flexibility and choice afforded in respect of these portions is outlined below.

700 MHz Duplex

4.19 Article 3(1)(a) of the EC 700 MHz Decision provides that:

"When Member States designate and make available the 700 MHz frequency band for use other than high-power broadcasting networks, they shall:

(a) designate and make available the [700 MHz Duplex] frequency bands, on a non-exclusive basis, for terrestrial systems capable of providing wireless broadband electronic communications services in compliance with the parameters set out in Sections A.1, B and C of the Annex".

4.20 ComReg would highlight that the Annex to this decision also provides:

"The frequency bands 703-733 MHz and 758-788 MHz [i.e. 700 MHz Duplex], or a subset thereof, may also be used for PPDR radio communications. Such use is addressed in Section A.1."

700 MHz Duplex Gap and 700 MHz Guard Bands

4.21 Article 3(1)(b) of the EC 700 MHz Decision provides that:

"When Member States designate and make available the 700 MHz Band for use other than high-power broadcasting networks, they shall:

(b) "subject to national decisions and choice, designate and make available the [700 MHz Duplex Gap[50] and 700 MHz Guard Bands[51]] portions of the 700 MHz frequency band, for use in compliance with the parameters set out in Sections A.2 to A.5 of the Annex".

4.22 Member States' flexibility in terms of the potential uses of the 700 MHz Duplex Gap and 700 MHz Guard Bands (which are not mutually exclusive) can be summarised as follows[52]:

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46 Note that the 1 MHz above 790 MHz is also subject to the 800 MHz EC Decision (2010/267/EU), where it is identified as a guard band before the lower duplex of the 800 MHz band which starts at 791 MHz.

47 Which is defined in the EC 700 MHz Decision as follows:

"*'wireless audio PMSE equipment' means radio equipment used for transmission of analogue or digital audio signals between a limited number of transmitters and receivers, such as radio microphones, in-ear monitor systems or audio links, used mainly for the production of broadcast programmes or private or public social or cultural events*"

48 Which is defined in the EC 700 MHz Decision as follows:

"*'public protection and disaster relief (PPDR) radio communications' means radio applications used for public safety, security and defence used by national authorities or relevant operators responding to the relevant national needs in regard to public safety and security including in emergency situations.*"

49 Which is defined in the EC 700 MHz Decision as follows:

"*'machine-to-machine (M2M) radio communications' means radio links for the purpose of relaying information between physical or virtual entities that build a complex ecosystem including the internet of Things; such radio links may be realised through electronic communications services (e.g. based on cellular technologies) or other services, based on licensed or unlicensed use of spectrum.*"

50 In the frequency range 733–758 MHz.

51 The 700 MHz Guard Bands comprises:

- the "700 MHz Lower Guard Band": in the frequency range 694 – 703 MHz; and
- the "700 MHz Upper Guard Band": in the frequency range 788 – 791 MHz.

52 As set in Sections A.2 to A.5 of the Annex to the 700 MHz EC Decision.

- Supplemental Downlink ("SDL"): of up to 20 MHz within the frequency range 738-758 MHz (i.e. up to 20 MHz of the 700 MHz Duplex Gap);
- PPDR: where the frequency arrangement could consist of:
  a) 2 × 5 MHz in the frequency range 698-703 MHz (i.e. part of the 700 MHz Lower Guard Band) and 753-758 MHz (i.e. part of the 700 MHz Duplex Gap); and/or
  b) 2 × 3 MHz in the frequency range 733-736 MHz (i.e. part of the 700 Duplex Gap) and 788 – 791 MHz (i.e. the 700 MHz Upper Guard Band);
- M2M radio communications: the frequency arrangement could consist of 733-736 MHz (i.e. part of the 700 MHz Duplex Gap) and 788 – 791 MHz (i.e. the 700 MHz Upper Guard Band); and
- Wireless PMSE: the frequency arrangement could consist, in full or in part, of 694 – 703 MHz (i.e. the 700 MHz Lower Guard Band) and/or 733 – 758 MHz (i.e. the 700 MHz Duplex Gap).

Obtaining clarity on national policy

4.23 In Document 18/60[53], ComReg stated its intention to address the issue of engaging with stakeholders with a view to obtaining greater clarity on national policy on the use of the 700 MHz Duplex Gap in Ireland in its forthcoming Radio Spectrum Strategy Statement consultation.

4.24 Given the flexibility afforded in respect of potential PPDR use of the 700 MHz Duplex portion, ComReg will also be engaging with stakeholders with a view to develop clarity on same.

4.25 In light of the above, these items have been identified as a work plan item in Chapter 5 of this document.

1.4 GHz Band (1.4 GHz Centre Band and 1.4 GHz Extension Bands)

4.26 The 1452-1492 MHz frequency band ("1.4 GHz Centre Band") has remained unused in most European countries for the past two decades. Since 2002, the 1452-1479.5 MHz sub-band has been harmonised for terrestrial audio broadcasting systems (T-DAB) through the Maastricht 2002 Special Arrangement.

4.27 In 2003, the 1479.5-1492 MHz sub-band was harmonised for satellite digital audio broadcasting (S-DAB). This harmonisation was withdrawn in 2013, however, given the lack of substantial developments in this sub-band by the broadcasting-satellite service within the CEPT.

4.28 In late 2010, the ECC undertook a review of the use of the 1.4 GHz Centre Band with the aim of enabling its use for new services and applications that could bring substantial social and economic benefits for Europe. The ECC concluded that it should be harmonised for mobile broadband/mobile supplemental downlink ("SDL").[54]

4.29 At WRC-15, the two frequency bands adjacent to 1452-1492 MHz (i.e. 1427-1452 MHz and 1492-1517 MHz) (together the "1.4 GHz Extension Bands") were identified globally for IMT. The 1.4 GHz Extension Bands were harmonised in November 2017 by the ECC[55] for Mobile/Fixed Communications Networks Supplemental Downlink ("MFCN SDL"). In April 2018, the EC issued an implementing decision which harmonises the entire 1.4 GHz Band (i.e. 1427 – 1517 MHz) for terrestrial systems capable of providing ECS in the EU ("1.4 GHz EC Decision").[56]

4.30 These actions have made the 90 MHz in the 1427 – 1517 MHz band available for wireless

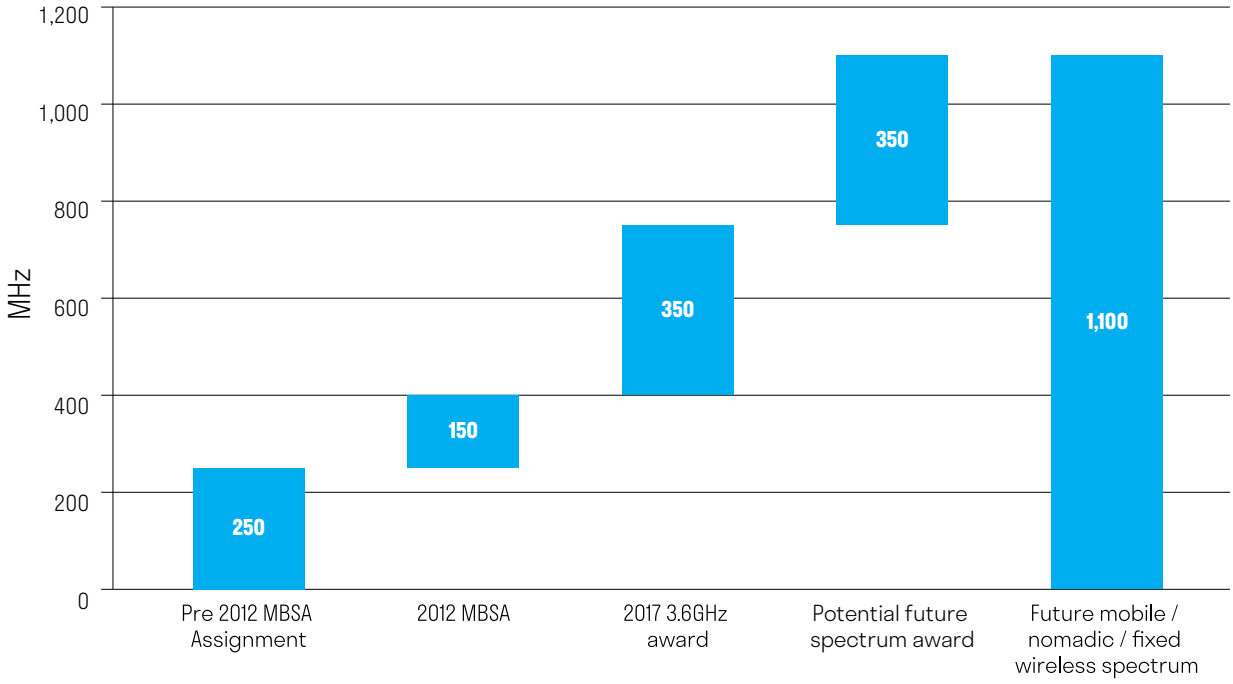
53 ComReg Document 16/80 – Proposed multiband spectrum award – preliminary consultation on which bands to award.

54 ECC Report 188 - Future Harmonised Use of the 1452-1492 MHz in CEPT – 19 February 2013: available at www.ecodocdb.dk.

55 ECC/DEC/(17)06 - The harmonised use of the frequency bands 1427-1452 MHz and 1492-1518 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL) – 17 November 2017: available at www.ecodocdb.dk.

56 Commission Implementing Decision (EU) 2018/661 of 26 April 2018 amending 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 as regards its extension in the harmonised 1427-1452 MHz and 1492-1517 MHz frequency bands.

Spectrum for 5G



broadband SDL. However, in Ireland the 1.4 GHz Extension Bands are used to facilitate low-bandwidth links used predominantly by radio broadcasters and utilities. As of June 2018, there are 103 fixed links licensed in the 1.4 GHz Extension Bands.

4.31 The 1.4 GHz EC Decision provides that Member States should have national flexibility to use portions of the 1.4 GHz Extension Bands to cater for international military agreements or to respond in a time-limited manner to specific national needs for the continued operation of terrestrial fixed wireless services. The 1.4 GHz EC Decision also emphasises that the technical work undertaken in developing the harmonisation decision has shown that co-frequency operation of mobile and fixed services is not feasible. Where a Member State designates and makes available only a portion of the 1.4 GHz Extension Bands to ECS, Article 1(4) of the 1.4 GHz EC Decision clarifies that, following 1 January 2023, this is subject to the Member State identifying no national demand for wireless broadband ECS.

4.32 The future use of the 1.4 GHz Band is part of an ongoing ComReg consultation (Document 18/60)[57]. For the reasons detailed in said document, ComReg's preliminary view is that the 1.4 GHz Band (both the 1.4 GHz Centre Band and the 1.4 GHz Extension Bands) should not be included in the Proposed Award. While this issue is currently subject to consultation, ComReg considers it appropriate to include a work plan item for 2019-2021 to monitor developments in the 1.4 GHz Band and to consider the current and future use of the band in the event that it is not ultimately included in the Proposed Award.

4.2.2 Forthcoming EC Harmonisation Decisions

3.6 GHz and 26 GHz frequency bands

4.34 In July 2018, the ECC adopted CEPT

57 See section 3.2 of ComReg Document 18/60 – Proposed Multi Band Spectrum Award: Preliminary consultation on which spectrum bands to award.

Mobile data traffic in Ireland increased by over 900% in the five years to 2017

Reports 67[58] and 68[59] which were developed in response to an EC mandate[60] to develop harmonised technical conditions for the 3.6 GHz and 26 GHz frequency bands to support the introduction of next generation wireless systems in those bands.

4.35 On foot of CEPT Report 67, the RSC developed a draft implementing decision to amend Decision 2008/411/EC[61] to ensure that the technical conditions as set out in the annex to that decision enable the roll out of 5G technology in the 3.6 GHz band. ComReg has made provision in the work plan for the implementation of this decision during the forthcoming strategy period.

4.36 In addition, the RSC is developing an implementing decision to enable the roll out of next generation terrestrial wireless systems in the 26 GHz band. ComReg understands that Member States will be obliged to implement same during the period 2019 – 2021 and, therefore, provision has been made for the implementation of said implementing decision in the work plan.

4.37 In line with the mandate on the 3.6 GHz and 26 GHz bands (and the associated reports and decisions), and in order to ensure that all of the bands identified for MFCN are capable of supporting next generation wireless technologies, the RSC is currently drafting a mandate to CEPT to develop harmonised technical conditions for the 900 MHz, 1800 MHz, paired terrestrial 2 GHz and 2.6 GHz bands suitable for next-generation (5G) terrestrial wireless systems.

4.38 ComReg anticipates that a number of CEPT Reports will be developed on foot of this mandate and that these CEPT reports will, in turn, give rise to associated EC harmonisation decisions that Member States will be obliged to implement during the period 2019 – 2021. As such, provision has been made for the implementation of such EC harmonisation decision/s in the work plan.

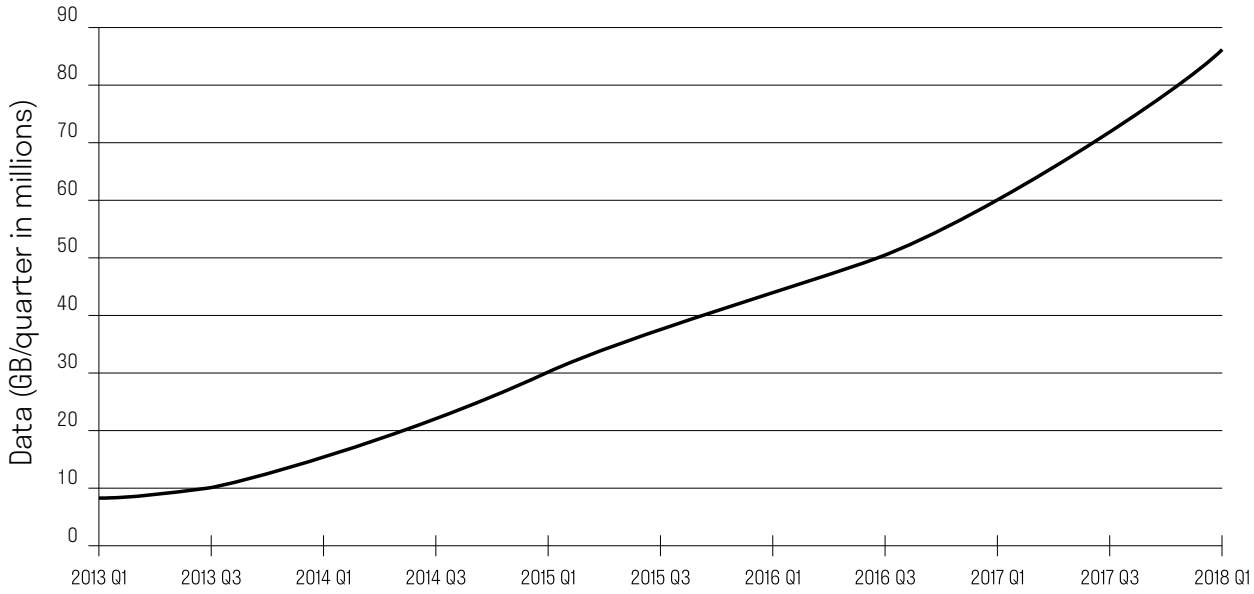
58 CEPT REPORT 67 Report A from CEPT to the European Commission in response to Mandate "to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union. Review of the harmonised technical conditions applicable to the 3.4-3.8 GHz ('3.6 GHz') frequency band.

59 CEPT Report 68 Report B from CEPT to the European Commission in response to Mandate "to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union. Review of the harmonised technical conditions applicable to the 24.25-27.5 GHz ('26 GHz') frequency band.

60 Mandate to CEPT to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union.

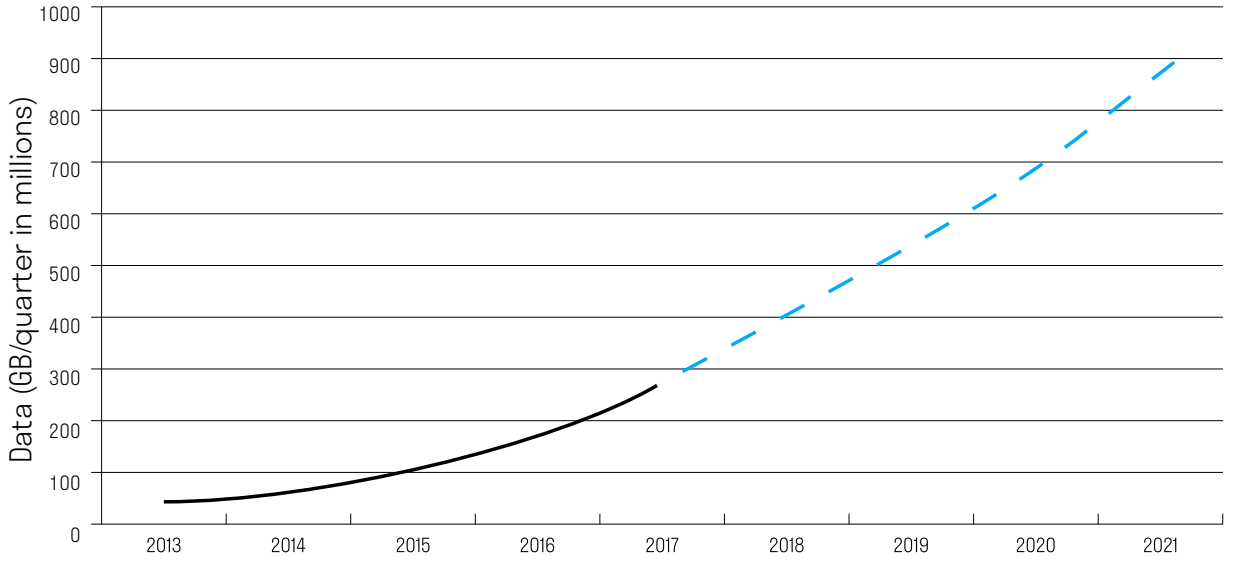
61 EC Decision 2008/411/EC on the harmonisation of the 3400 – 3800 MHz frequency band for terrestrial systems capable of providing electronic communications series in the Community.

Figure 4:
Total mobile data traffic in Ireland (GB/quarter)



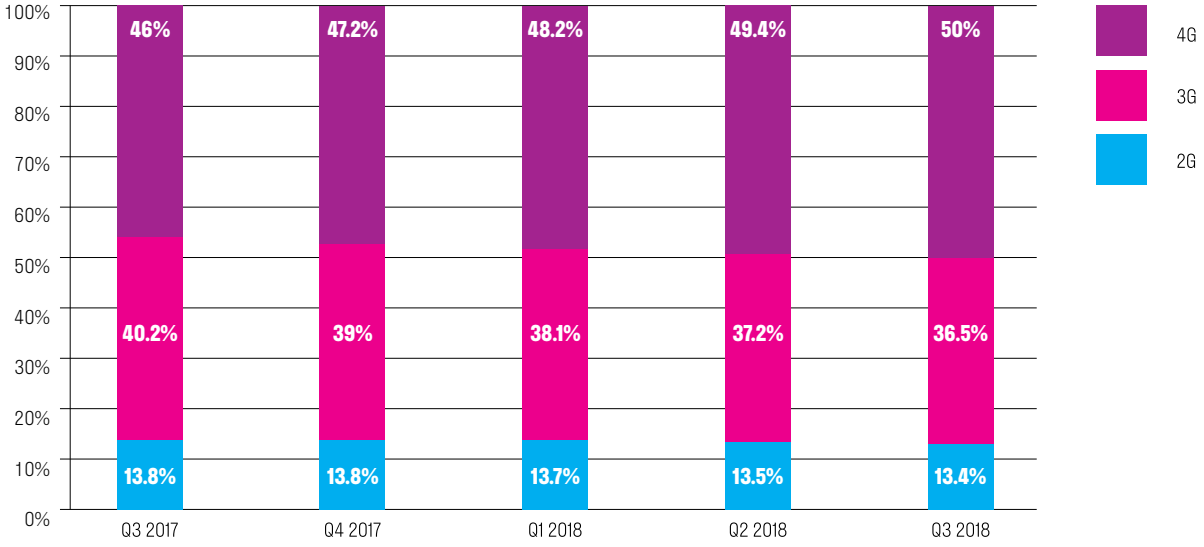
Source: 2018 ComReg 'Quarterly Key Data Report' (Document: 18/49)

Figure 5:
Base forecast of mobile data traffic in Ireland (GB/Year)



Source: 2018 Frontier 'Mobile Data Traffic Forecast in Ireland' (Document: 18/35)

Mobile Subscriptions by Technology Used, Q3 2017 – Q3 2018



4.3 End user demand for mobile data

4.39 Mobile data traffic in Ireland increased by over 900% in the five years to 2017 (from 8 million GB per quarter to 77 million GB per quarter), representing an average annual growth rate of around 60%. See Figure 4.

4.40 This period of rapid growth coincides with expansion of 3G networks in 2013[62] and the launch of the 4G networks following the assignment of "liberalised" spectrum rights of use in 800 MHz, 900 MHz and 1800 MHz bands in ComReg's Multi-Band Spectrum Award ("MBSA") in November 2012.

4.41 As at Q1/2018, the average traffic per smartphone user reached 5GB of data per month, while the average traffic per dedicated mobile broadband subscriber was 11.4 GB of data per month. This represents a 50% year-on-year increase for smartphone usage and a 25% year-on-year increase for mobile broadband usage. By way comparison, in the same period in 2013, the average traffic per smartphone user was 400 MB of data per month and 3.8 GB per month for mobile broadband.

4.42 Further increases in the demand for mobile data is expected, with an average annual growth of 32% predicted to 2022.[63] Total annual mobile data traffic is forecast to increase from 268 million GB/year in 2017 to 888 million GB/year in 2021 (see Figure 5).

4.3.1 Factors driving mobile data usage

4.43 The increase in the demand for mobile data is driven by a number of factors:

- On the demand-side, the growing use of mobile devices for audio-visual content and sending data-rich content via social networks is increasing data usage; and
- On the supply-side, increased availability of 4G services and sophisticated devices entering the market along with the declining cost of data plans driven by retail competition (including "all you can eat" plans) will continue to impact consumption patterns.

4.44 The various demand- and supply-side factors are briefly discussed below.

62 In particular, deployment of UMTS in the 900 MHz band allowed MNOs to provide 3G services across a wider geographic area.

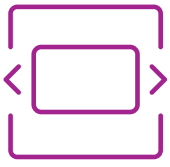
63 Document 18/35: https://www.comreg.ie/?dlm_download=mobile-data-traffic-forecast-in-ireland

Demand side factors

- **Demographic** - mobile phones are ubiquitous in Ireland, with 102% penetration as at 2017. Hence, population growth contributes to mobile data consumption. Patterns of usage differ across age groups, with smartphone ownership averaging 94% for mobile phone users below 50 years of age, compared to 62% for users above 50. As more than 60% of the Irish population are aged below 45, the prevalence of smartphones in this group seems likely to sustain the rise in mobile data consumption.

- **Handset upgrades** - the median age of mobile phones in Ireland was one to two years in 2017, with users typically upgrading their handsets every two years, and 40% of users are upgrading handsets even more frequently. As users continue to update their handsets to more sophisticated versions (e.g. with higher screen resolution and faster processing power), demand for mobile data will likely continue to grow.

- **Consumption trends** - consumption of video on mobile devices has been a key driver of increased mobile data usage, with 64% of mobile phone users watching video-on-demand in 2017, compared to 49% in 2015. This is attributed to the rising popularity of social media and embedded short videos, which is expected to endure.



- **Richer web pages** - websites have and will continue to be more sophisticated, with richer content such as embedded videos, higher resolution images and embedded video advertising. With internet browsing taking up the most mobile data time for users (averaging 44 minutes daily), this will extend the data consumption impact.

Supply side factors

- **Increased coverage** - increases in mobile network coverage can be expected to increase mobile data consumption, by allowing access to a larger number of users. Hence, the roll-out of 3G and 4G networks have contributed to the consumption of mobile data by previously largely unserved areas of the population. Further network roll outs will augment the demand for mobile data.

- **Increased network speed** – increases in network speed enhance the ease of mobile usage by shortening download speeds. This raises mobile data consumption as consumers spend more of their time browsing or watching videos.

- **Improved devices** - mobile phone specifications have progressively improved as they have developed into converged multimedia devices. These improvements include higher screen resolution and better processing power, which enable faster loading and streaming of webpages and videos. These higher specifications also require greater data requirements to operate.

- **Tariff changes** - consumers increase their mobile data usage as the price of mobile data declines (e.g. 'all you can eat' tariffs and/or larger data usage allowances).

4.4 Technology changes and advancements

4.45 Technology changes[64] 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, can result in faster or higher quality services being provided which may be sufficient to address increasing end-user demand for services. In other instances, this can result in spectrum being reallocated from one service to another.[65]

4.46 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 using carrier aggregation. An example of such advancements can be found in the area of internet of agriculture ("IoA"). IoA technologies could play a vital role in boosting Ireland's agricultural success. With the advent of 5G, additional capabilities might be enabled such as autonomous farm vehicles and AI-enabled crop planning and management.

4.4.1 M2M and IoT

4.47 It is widely predicted that the deployment of IoT, including M2M communications, will increase over the coming years[66]. IoT devices include thermostats, smart meters, light bulbs, door locks, fridges, cars and for Radio Frequency Identification and pacemakers. ComReg observes that the number of M2M and IoT devices is predicted to increase from 8.4 billion units in 2017 to 20 billion units by 2020 worldwide.[67]

4.48 While certain M2M/IoT technologies, such as NB-IoT, are designed to operate in spectrum bands assigned to MFCN, the vast majority of M2M and IoT technologies will operate in the licence-exempt bands.

4.4.2 Spectrum for 5G

4.49 While the final requirements for all aspects of 5G have yet to be finalised[68], there is common agreement on the main families of usage scenarios and applications that 5G might support, being:

- enhanced WBB connectivity;
- connectivity of millions of devices that would enable massive machine type communications; and
- resilient, instantaneous connectivity that would enable ultra-reliable and low latency communications.

4.50 In its response to consultation and decision on the 26 GHz Spectrum Award 2018 (Document 18/12), ComReg set out its views on spectrum that could be used for 5G services.[69] ComReg observed that 5G spectrum award matters generally would be considered as part of the next Radio Spectrum Management Strategy Statement consultation.

4.51 For spectrum below 6 GHz, the RSPG's first (RSPG 16-032) and second (RSPG 18-005) opinions identify:

- the 3.6 GHz Band as the primary band for 5G (which has already been awarded by ComReg); and
- that 5G will need to be deployed in bands already harmonised below 1GHz, including, in particular, the 700 MHz Band.

4.52 ComReg notes that spectrum bands already licensed (in particular the 3.6 GHz Band) and spectrum bands identified for potential award (in particular the 700 MHz Band) are part of the specifications for 5G[70] that were released by the

64 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.

65 For example, the switch-off of analogue TV broadcasting 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 WBB services.

66 https://ovum.informa.com/resources/product-content/press-release-2017-iot-predictions

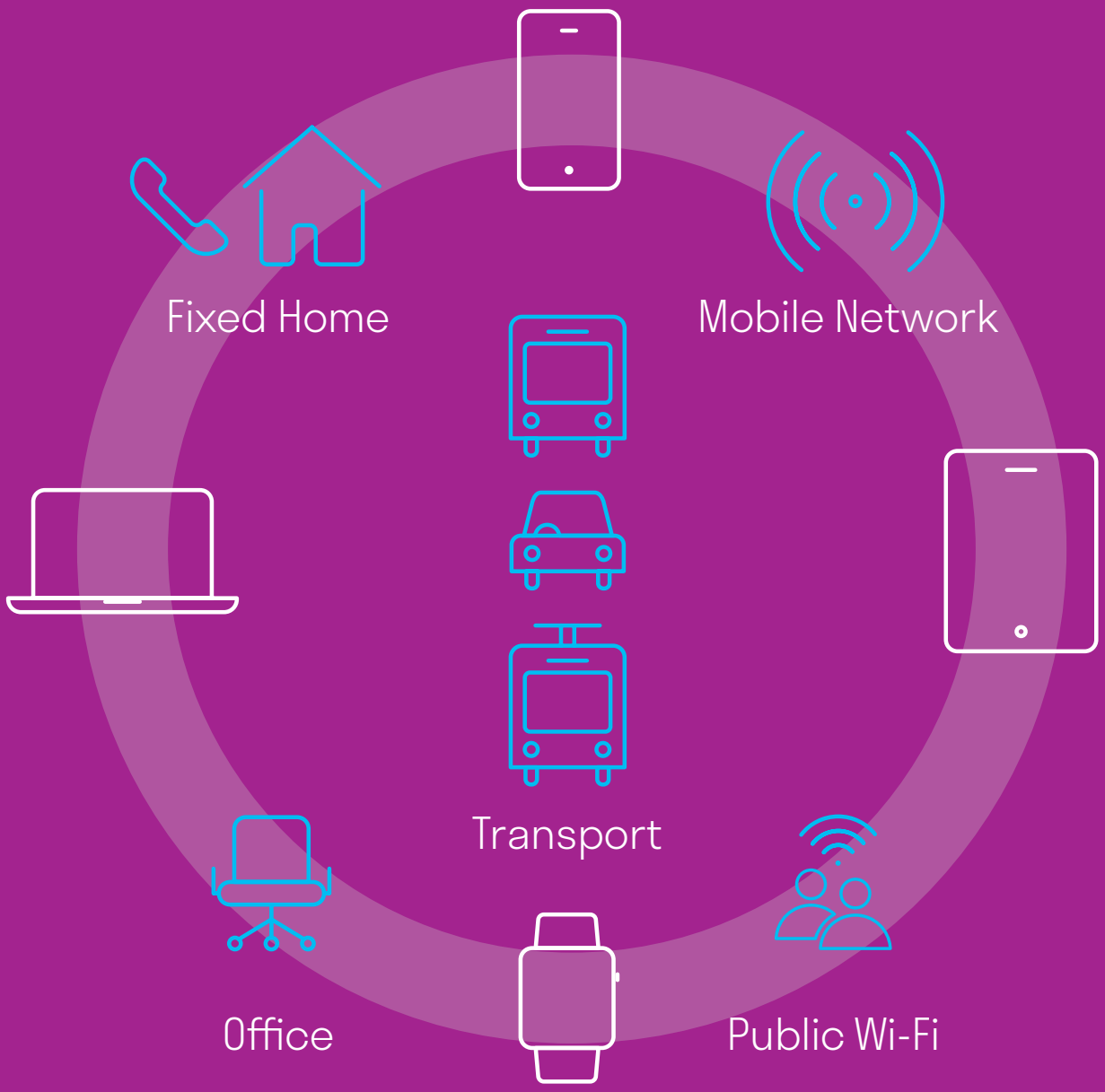
67 https://www.gartner.com/newsroom/id/3598917

68 Noting that, on June 2018, the 3GPP finalised the 5G NR standalone specifications: https://www.mobileworldlive.com/featured-content/top-three/3gpp-clears-5g-for-take-off-with-standalone-nr-specs/

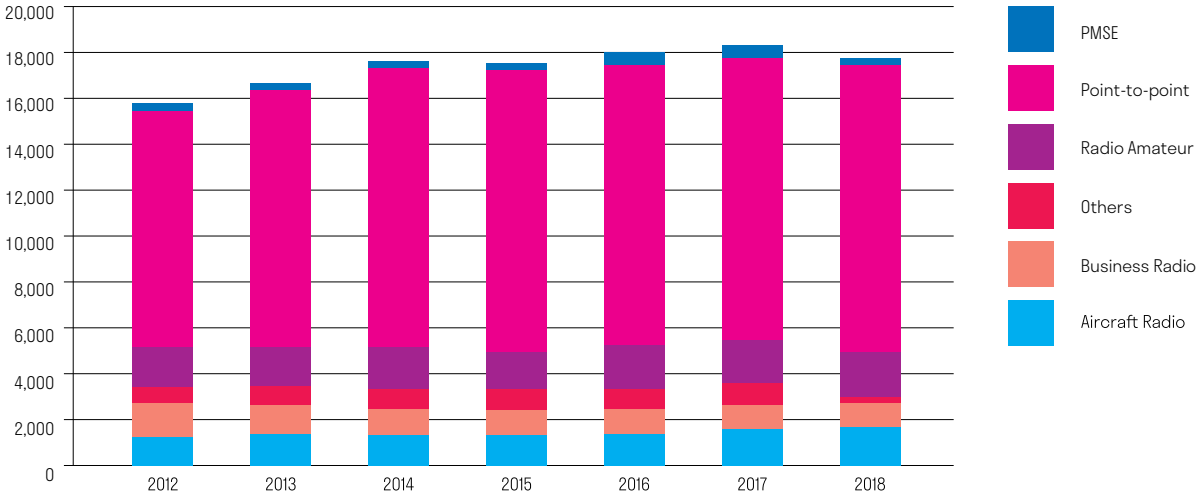
69 See section 2.2.

70 Specifically, the specifications will refer to the 5G New Radio (NR) bands.

We require connectivity for all of our devices where we live, work, travel and spend our leisure.



No. of licenses per annum as of 30 June



third Generation partnership Project ("3GPP") in mid-2018 and that this may delay interest in, and demand for, spectrum in the 26 GHz Band for 5G.

4.53 For spectrum above 6 GHz, and in respect of a Strategic Roadmap towards 5G for Europe, the RSPG has published two opinions on this matter.

4.54 In its first opinion[71], the RSPG:

- recommended the 26 GHz band as a pioneer band for 5G above 24 GHz in Europe;
- recognised that the band 31.8 – 33.4 GHz looked promising and could be made available relatively easily by many European administrations, taking into account the existing fixed service deployment in this band, for future deployment of 5G services; and
- considered that the band 40.5 – 43.5 GHz (42 GHz) was a viable option for 5G in the longer term, taking into account the support from mobile industry and the need to take into account the general balance between mobile and satellite sector to access the 40/50 GHz range.

4.55 In its second opinion[72], the RSPG:

- reaffirmed its view that the 26 GHz Band is the key "mmWave" pioneer band for 5G in Europe;
- having considered sharing studies, industry interest and the size of the 31.8 - 33.4 GHz band, noted that this band should no longer be considered as a priority;
- whilst still of the opinion that the 42 GHz band is a priority band for Europe for 5G, noted that there is no urgency in potential harmonisation of this band; and
- considered that the 66 - 71 GHz band should now also be prioritised in terms of studies for second stage mmWave 5G bands.

4.56 In its second opinion, the RSPG noted in relation to the 26 GHz "pioneer" band that:

- Member States should make by 2020 a sufficiently large portion of the band, e.g. 1 GHz, available for 5G in response to market demand, taking into account that 5G deployment in this frequency range is expected to be used for local coverage; and

71 RSPG16-032 – RSPG strategic roadmap towards 5G for Europe, Opinion on spectrum related aspects for next generation wireless systems (5G) – 9 November 2016.

72 RSPG18-005 – RSPG strategic roadmap towards 5G for Europe, RSPG second opinion on 5G networks – 30 January 2018.

- Regulatory flexibility for the progressive release of the 26 GHz band will facilitate an efficient introduction of 5G without having an unnecessary negative impact on the current users of the band.

4.57 ComReg observes that CEPT ECC Decision (18)06[73] on harmonised conditions for MFCN in the 26 GHz band will form the basis of the EU harmonisation action in respect of this band, and notes that initial MFCN deployments in many CEPT countries is expected in the 26.5 – 27.5 GHz frequency range.

4.58 ComReg also understands that the EECC obliges Member States to allow the use of some of the 26 GHz Band for WBB by end-2020 and has noted this in its consideration of the 26 GHz Band in Document 18/60.[74]

4.59 ComReg notes that the 26.5 – 27.5 GHz frequency range is unassigned in Ireland in the event that the 26 GHz band becomes required for 5G MFCN services.

4.4.3 Technological developments in the fixed link frequency bands

4.60 With mobile networks expected to achieve data throughputs in the region of gigabit-per-second ("Gbit/s") to end-users in the future, and taking into account associated small cell deployments and increased macro-cell capacity requirements, ComReg anticipates that this will have a significant bearing on backhaul capacity requirements in both existing and new fixed link microwave bands. ComReg views the upper frequency bands (i.e. 50 GHz and above) as being potential key facilitators for such high traffic volumes.

4.61 Backhauling needs to satisfy apparently conflicting requirements such as:

- increase of capacity that can be supported on the link;
- increased spectrum efficiency to maximise the use of the radio spectrum;
- low power consumption to reduce the costs of operations; and
- low environmental impact to satisfy planning rules.

4.62 Due to technology evolution and availability of wide channel bandwidths at higher frequencies, the use of frequency bands in the V-Band, E-Band, W-band and D-Band appear to be of interest for the future needs for backhaul networks as they are promising in term of providing multi-Gbit/s channels.[75]

4.63 Given the different nature of these frequency bands, different scenarios might be foreseen for each band, including macro and small cell backhaul, front-haul applications, line of sight ("LoS") today, and possibly near line of sight ("nLoS") in the future.

4.64 Timely consideration is required in order to efficiently and effectively cater for the expected increase in backhaul capacity requirements. At the same time, the projected increase in backhaul capacity requirements may also potentially be offset by further developments in fixed link technologies, such as the emergence of more efficient modulation techniques.

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73 https://www.ecodocdb.dk/document/3361

74 ComReg Document 18/60 – Proposed Multi Band Spectrum Award: Preliminary consultation on which spectrum bands to award.

75 There is some confusion about microwave frequency band letter definitions, since there is no unique view in literature and the satellite industry and fixed-link industry designators do not align. Each letter definition is widely variable depending on the standardisation / development body that first used the designation. See annex 2 for a list of commonly used spectrum designators used in the satellite communications.

For the purpose of fixed links:

- the V-band is characterized by a continuous block of spectrum between 57 and 71 GHz (however, the lower portion spanning from 48.5 GHz to 57 GHz is generally included in the V- band definition). In this band oxygen absorption can aid link designers in providing additional resistance to radio interference as well as enhanced frequency reuse;
- The E-Band (which covers 71 - 76 GHz and 81-86 GHz) enables Gbit/s data rates given the large amount of available spectrum (10 GHz) without any oxygen absorption, thus allowing longer distances compared to the V-Band.
- The W-band (92-114.25 GHz) has been indicated as the possible complement for the E-Band when the latter reaches saturation; and
- The D-band (130 – 174.8GHz) has been suggested as a possible additional band to the V-band.

There has been significant growth in the number of applications for fixed links in the E-band in recent years. Of the 849 fixed links currently licensed in the E-band, 76% are located in the Dublin region.

Fixed links in the E-Band (71 – 76 GHz and 81 – 86 GHz)

4.65 As set out in Chapter 3 of Consultation 18/74[76], there has been significant growth in the number of applications for fixed links in the E-band in recent years. Of the 849 fixed links currently licensed in this band, 76% are located in the Dublin region. This demand of E-band links for the Dublin region has, in recent months, resulted in limited channel availability for new applications. As such, ComReg is of the view that this band is reaching saturation in the Dublin region and that it may be necessary to close this band to new applications shortly.

4.66 In order to inform any decision that it might make with regard to the E-band, a thorough analysis of the existing links, including geographical distribution and channel bandwidth, is required. ComReg has therefore included this as a work plan item in Chapter 5.

4.67 Until recently the maximum channel spacing that has been requested in the E- Band has been 750 MHz, with modulations schemes ranging from 4QAM up to 256QAM. However, recent representations made to ComReg suggest that:

- operators are seeking higher channel spacings of 1000 MHz and 2000 MHz and also lower modulation schemes such as 4FQAM, 4HQAM and 4SQAM;
- path lengths at these lower modulations can reach up to 8km;
- in order to achieve these longer path lengths, larger channel spacings and lower modulation schemes are required;
- these lower modulation schemes result in a reduction in link availability below the level currently permitted in ComReg's Radio Links Guidelines (of 99.95% in this band);
- the relevant ETSI standard (EN 302 217 – 3) currently has no interference provisions for 1000 MHz and 2000 MHz spacing over 16QAM, which results in ComReg's interference analysis in this band being less than 100% accurate; and
- ETSI is currently drafting a revision to the standard for E-Band interference analysis to address the aforementioned issues.

4.68 Consequently, and in order to consider accommodating longer links with lower modulation and the minimum availability, ComReg has made provision in its work plan to amend its Radio Links Guidelines once the revised ETSI standards are in place.

76 Document (18/74) - https://www.comreg.ie/publication/proposed-strategy-for-managing-the-radio-spectrum-2019-2021/

Fixed links in the 130 - 134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167 - 174.8 GHz bands

4.69 Alternative bands to the E-band for future use for high capacity links include the W-Band (92-114.25 GHz) and D-band (130 – 174.8 GHz). Both bands exhibit good propagation characteristics with low atmospheric gas attenuation. The band path loss of D-band is only 6 dB worse than that of E-Band, making D-band suitable for meeting the requirements of ultra-high capacity links.

4.70 While the current ETSI document (EN 302 217) does not cover frequencies above 86 GHz, ComReg is aware that ETSI is currently preparing technical material for possible inclusion of the range 130 GHz to 174.8 GHz in this series.

4.71 In addition, the CEPT has adopted a recommendation detailing the channelling arrangements for National Regulatory Authorities wishing to make these bands available for fixed links.[77]

4.72 ComReg will implement this recommendation once equipment for fixed links in these bands becomes available, and has included a work item to this effect in its work plan at Chapter 5.

Fixed links in the V-Band (57 – 64 GHz)

4.73 As noted above, propagation of radio waves in the V-band is limited due to oxygen-absorption attenuation. This aspect favours a high frequency reuse factor within the band with reduced requirements for frequency coordination.

4.74 Applications for this band have been very limited and preference appears to be for the E-band where propagation is not affected by oxygen-absorption to the same extent. Notwithstanding, ComReg is aware that:

- there are a large number of well-known manufacturers of equipment for point-to-point, point-to-multipoint and mesh networks that utilise this band;
- the band is favoured by a number of these manufacturers for future small-cell deployments to meet expected connectivity demands[78],[79]; and
- an ECC Recommendation is in place that facilitates the use of this band while providing protection for other users in the band.[80]

4.75 In light of the above, a review of the licensing regime currently in place for radio links appears prudent, with a view to implementing, if required, an appropriate licensing regime to facilitate the future use of this band.

4.5 Licences expiring in the near future

4.76 Where existing spectrum rights of use are due to expire in the near future (e.g. the next five years), ComReg endeavours to set out its proposals on the future use of such bands well in advance of expiry including, where appropriate, defining and carrying-out an assignment process for same.

4.77 There are a number of licences that will expire in the period 2019 – 2024 and ComReg sets out the current status of these bands and envisaged next steps below.

4.5.1 2.1 GHz band

4.78 The frequency range 1900-1920 MHz, 1920-1980 MHz and 2110- 2170 MHz ("the 2.1 GHz band) consists of 140 MHz of spectrum and is currently licensed in Ireland for the provision of Universal Mobile Telecommunications System ("UMTS" or "3G") services. These licences were issued following competitions in 2002 and 2007 and included two parts:

- paired FDD spectrum rights in the frequency range 1920 -1980 MHz and 2110 -2170 MHz ("Paired 2.1 GHz Band"); and
- unpaired TDD spectrum rights in the frequency range 1900-1920 MHz ("Unpaired 2.1 GHz Band").

77 ECC Recommendation 18(01) Radio frequency channel/block arrangements for Fixed Service systems operating in the bands 130 - 134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167 - 174.8 GHz.

78 https://www.siklu.com/custom-blog/e-band-vs-v-band-batman-or-invisible-man-you-choose/

79 http://www.intracom-telecom.com/en/products/wireless_network_systems/4G_smallcell_son_backhaul/streetnodeV60.htm

80 ECC/REC/(09)01 – Use of the 57 – 64 GHz frequency band for point-to-point fixed wireless systems – January 2009

4.79 Spectrum rights in the Paired 2.1 GHz Band are currently licensed to Three, Vodafone and Meteor. The licences held by Three and Vodafone will expire in 2022 as follows:

- Three holds two licences in the 2.1 GHz Band, referred to as the "A Licence" (which expires on 24 June 2022) and the "B Licence" (which expires on 1 October 2022)[81]; and
- Vodafone holds one licence which expires on 15 October 2022.

4.80 The licence held by Meteor expires on 11 March 2027.

4.81 In Document 18/60, ComReg set out its preliminary view that the Paired 2.1 GHz Band should be included in its proposed award of spectrum rights of use suitable for the provision of WBB.

4.5.2 All Island Licence in the 1785 – 1805 MHz band

4.82 In 2007, a joint ComReg/Ofcom spectrum award was concluded which resulted in the granting of a licence for the 1785 – 1805 MHz frequency band for mobile wireless services on an all-island basis. On foot of same, a separate licence was issued in both jurisdictions to a single entity, Personal Broadband[82], for a period of 15 years. In Ireland, the licence was granted on 25 April 2007 under the Wireless Telegraphy (1785–1805 MHz Wireless Access Services) Regulations (S.I. 172 of 2007). This licence is due to expire on 24 April 2022.

4.83 In considering potential future uses of this band, ComReg notes:

- Regulation 6(1) of S.I. 172 of 2007 states that all licences shall expire after 15 years;
- there is no provision in S.I. 172 of 2007 for the renewal of licences granted under same;
- that commercial services have not been deployed in either jurisdiction using the spectrum rights held under the licence;
- in 2014, the EC adopted Implementing Decision 2014/641/EU which requires Member States to designate and make available the 1785 – 1805 MHz band for audio PMSE on a non-interference, non-protected basis;
- ComReg has implemented this decision for PMSE use in Ireland;
- the 1785-1805 MHz band is not subject to any harmonisation decision within CEPT or the EU for MFCN;
- there are no plans at either an EU or ITU level to allocate the band for MFCN; and
- ComReg has set out its general position on the issue of licence expiry/ renewal in a number of publications.[83]

4.84 ComReg envisages that, following engagement with Ofcom, it will make a determination on the future of this band during the forthcoming strategy period.

4.5.3 Third Party Business Radio

4.85 ComReg launched its Third Party Business Radio ("TPBR") licensing scheme in 2005 for the provision of private mobile radio ("PMR") services to third parties in the UHF and VHF frequency bands. Licences under this scheme are national in scope and are granted for a period of 5 years.

4.86 The licensing scheme was re-opened in 2011 and again in 2016, enabling both existing licensees whose licenses are expiring, and new licensees, to apply for new licences for a further 5 year period. Following the re-launch of the scheme in 2016, ComReg granted licences for 43 channels, each of 12.5 kHz bandwidth, to 12 licensees. The demand for TPBR licences is shown in Figure 7.

4.87 In light of the constant demand for spectrum under this licensing scheme and the inefficiencies associated with periodically opening and closing the licensing scheme[84], ComReg will consult on keeping the TPBR licensing scheme open on an ongoing basis (including, for example, issuing 5 year

81 Three also holds spectrum rights for an additional 5 MHz block in the Unpaired 2.1 GHz Band as part of its B Licence. Vodafone and Meteor previously held an equivalent 5 MHz block in the Unpaired 2.1 GHz Band, which were returned to ComReg on 11 March 2011 and 28 February 2013, respectively.

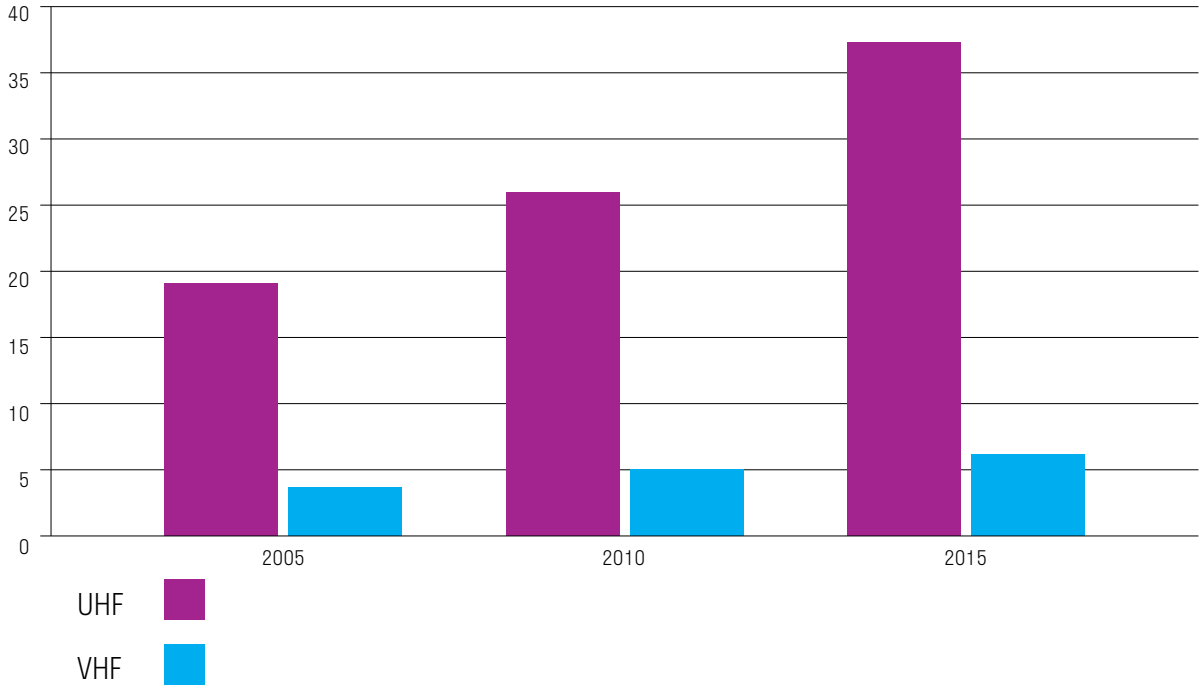
82 Personal Broadband was purchased by Netiv Ltd. in 2016, which is now the licence holder.

83 See, for instance, ComReg 16/50 – Radio Spectrum Management Strategy Statement 2016 – 2018.

84 For example:

- spectrum is readily available in the VHF and UHF bands that could be assigned to TPBR; and
- opening and closing the scheme may act as a barrier to existing and potential users efficiently acquiring spectrum rights of use as required.

Figure 7:
Number of TPBR licences issued



licences on a first-come-first-served basis, with a simple mechanism to address demand exceeding supply on any given day). ComReg has made provision for this work in its work plan as set out in Chapter 5

4.5.4 National Telemetry Licences

4.88 Following a public consultation process[85], in July 2014 ComReg introduced a licensing scheme for telemetry systems operating on a local or national level.[86]

4.89 On foot of this process, ComReg granted three national telemetry licences, two to ESB and one Irish Water under the Wireless Telegraphy (Licensing of Telemetry Systems) Regulations (S.I. 240 of 2014). Each licence comprises a block of 12 channels of 2 × 12.5 kHz of spectrum in the UHF band. Each licence has a duration of 10 years and will expire in July 2024.

4.90 While ComReg will not be making a determination on the future use of this band during the forthcoming strategy period, ComReg observes that:

- these are non-harmonised bands;
- ComReg is not aware of any plans to harmonise these bands in Europe prior to 2024; and
- each licensee has rolled out extensive national telemetry networks to support its operations.

4.91 In light of the above, a work plan item to address the future of the National Telemetry licensing regime does not appear to be required for the period 2019-2021, although ComReg expects such an item to appear in the subsequent strategy period.

85 ComReg Document 13/77 – The introduction of a licencing framework for VHF and UHF telemetry systems.

86 Telemetry system means a wireless telegraphy system by which automated measurements are made and other data collected at remote or inaccessible locations, and transmitted to receiving stations for monitoring, recording or remote control purposes.

Radio Spectrum work plan for the period 2019 – 2021

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.

5.1 In light of the matters discussed in the preceding chapters and ComReg's response to consultation (Document 18/117), this chapter sets out ComReg's radio spectrum work plan for the period 2019 – 2021.

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

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

5.3 As previously outlined, ComReg's radio spectrum workload is driven by a wide range of items including:

- the expiry of existing licences - where existing spectrum rights of use are due to expire within the near future, ComReg endeavours to set out its proposals on the future use of such bands well in advance of expiry including, where appropriate, defining and carrying out an assignment process for same;
- the potential for additional spectrum bands to be released - given developments such as the harmonisation of a spectrum band[87] or the potential for refarming a spectrum band[88], it may be appropriate to consider the release of additional spectrum bands; and
- other developments - this can relate to a wide range of external developments including national or EU legislation/policy developments[89], sector-specific or licensee requests etc.

5.1 Appropriate prioritisation of spectrum work activities

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

- The capacity within the existing radio spectrum bands to meet spectrum needs. Where capacity exists, it may be possible to meet this demand via the existing spectrum assignments or to award new assignments using existing authorisation processes;
- The timing of the expiry of existing rights of use and the requirement for an appropriate re-assignment process in light of factors such

87 For example, in 2018 EU Decision 2018/661 amended EU Decision 2015/750 to add the 1427-1452 MHz and 1492-1517 MHz frequency bands to the already harmonised 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services.

88 For example, the 700 MHz band is currently in the process of being re-farmed in Europe.

89 For example, it is expected that current European Common Regulatory Framework for ECN and ECS will to be superseded by the European Electronic Communications Code ("EECC") during the course of this forthcoming strategy period.

as end user demand, harmonisation status, equipment availability and availability of related spectrum bands;

- The international harmonisation status of a spectrum band including any future harmonisation plans;
- The harmonisation status and appropriate timing for release of spectrum bands that are currently unassigned;
- The potential to liberalise the current restrictions placed on licensees which could increase the efficient use of spectrum, facilitate innovation and potential free up capacity which could be made available for other uses;
- The potential for including multiple spectrum bands in a single award process where appropriate to meet ComReg's statutory objectives;
- The adoption of legislation (national or European) which requires ComReg to take defined actions within a set timeframe; and
- The potential for market mechanisms to address spectrum management issues.

5.2 ComReg's spectrum work plan 2019 to 2021

5.5 The following section outlines the indicative spectrum work plan that ComReg will carry out within the time period 2019 to 2021.

5.2.1 ComReg's spectrum management function (i.e. programmatic work)

5.6 ComReg's programmatic work items for the period 2019 – 2021 are to:

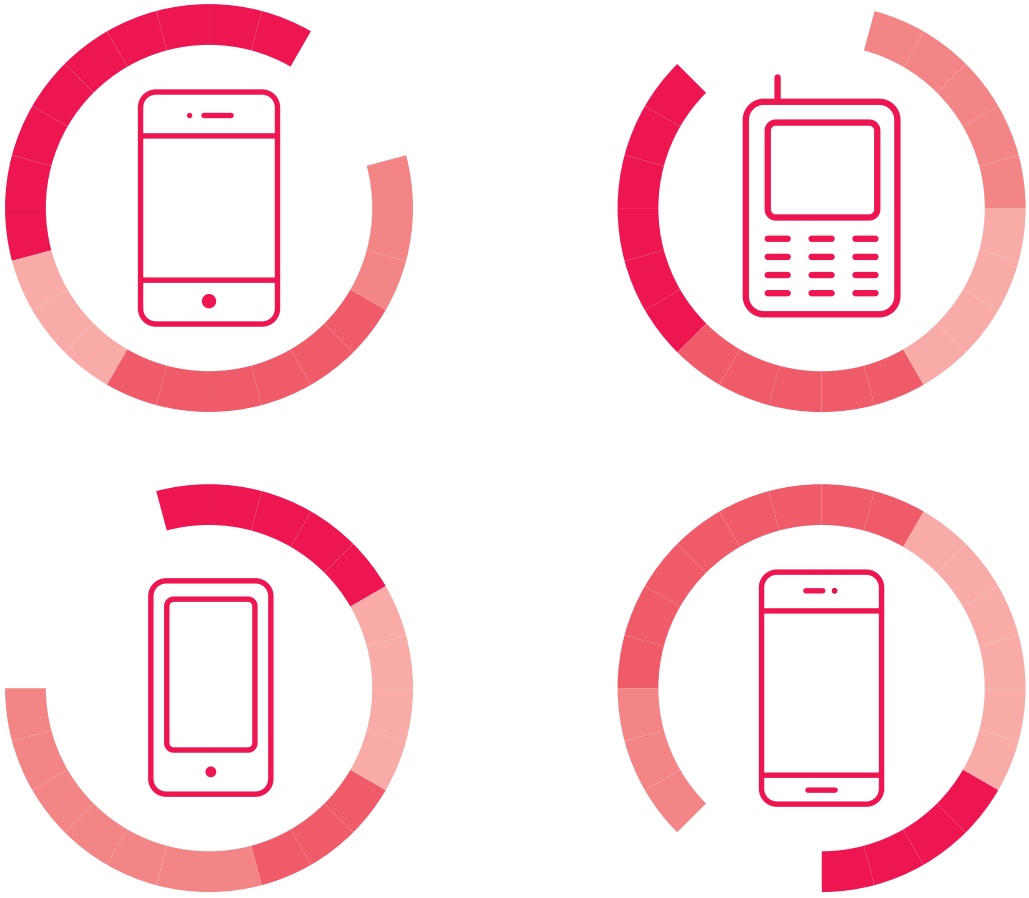
- Continue to issue licences for wireless telegraphy in accordance with the 1926 Act and the regulations associated with each licence type;
- Continue to conduct market surveillance on items being imported to the State through Customs;
- Continue to conduct surveys of transmission sites to assess compliance with licence conditions;
- Continue to monitor compliance and take enforcement action where appropriate;
- Continue to investigate radio interference, giving appropriate priority to cases that have safety-of-life implications;
- Continue to publish an annual report detailing activities in respect of market surveillance, investigations of radio interference and enforcement action;
- Continue a programme of measurement of NIR testing and publication of surveys on Siteviewer as appropriate;
- Continue to promote 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;
- Assist the DCCAE in the transposition of the EECC, and implement same as appropriate; and
- Consult on potential deployment of LoRa technology in the 900MHz band.

5.2.2 MFCN

5.7 ComReg's work plan items for MFCN for the period 2019 – 2021 are to:

- Develop and finalise its multi-band award proposals for the release of spectrum rights for the provision of wireless broadband (both mobile and fixed broadband) services, and implement same;
- Take appropriate administrative measures arising from the adoption of Decision (EU) 2018/637 - which amends Decision 2009/766/EC - to enable the deployment of M2M technologies in the 900 MHz and 1800 MHz frequency bands;
- Implement relevant EC harmonisation decisions in the bands for MFCN in support of next generation terrestrial wireless systems;
- Engage with the relevant stakeholders with a view to obtaining greater clarity on national policy on the use of the different portions of the 700 MHz Band in Ireland and, in particular, for PPDR;
- Monitor developments in the 1.4 GHz band for MFCN and consider the current and future use of the band in Ireland;
- Publish non-confidential information regarding ComReg's drive testing programme of mobile networks in Ireland;

Mobile handset performance varies significantly by device



- Continue to measure the performance of all new makes and models of mobile handsets that become available on the Irish market for both voice and data on a regular, ongoing basis;
- Consider how to best establish the aggregate effect of building materials on signal propagation including collaboration with other research bodies;
- Continue to liaise with MNOs to gather network architecture data for the generation of coverage prediction maps and make these available on the consumer section of ComReg's website;
- Consider administrative matters concerning the EC's spectrum divestment commitments in relation to the acquisition of Telefonica by Hutchison at the appropriate time;
- Continue to work with relevant parties to ensure the orderly and timely transition by existing FWALA licensees in the 3.6 GHz Band to enable services to be provided by the winning bidders in the award, in accordance with the transition rules of the award; and
- Monitor the progress of the developments in respect of 5G with a view to making a portion of the 26 GHz band available, if and when it is required.

5.8 ComReg observes that, arising from its work plan item to generate mobile coverage maps for publication on its website, it will consider other means of monitoring MNO compliance with their coverage obligations.

5.2.3 Broadcasting Services

5.9 ComReg's work plan items for the Broadcasting Service for the period 2019 – 2021 are to:

- Assist the DCCAE, RTÉ and 2rn as appropriate in facilitating the migration of DTT services from the 700 MHz band by 4 March 2020;
- Continue to manage and oversee the cost recovery mechanism for the migration of DTT services below the 700 MHz band;
- Continue to engage in the international coordination of broadcasting transmitter stations;
- Issue and amend DTT, DSB and ASB broadcasting licences as requested in line with the broadcasting licensing framework; and
- Provide advice as required to DCCAE in relation to spectrum for broadcasting services.[90]

5.2.4 Terrestrial Fixed Services

5.10 ComReg's work plan items for the Fixed Service for the period 2019 – 2021 are to:

- Consider opening up the 130 – 134 GHz, 141 – 148.5 GHz, 151.5 – 164 GHz and 167 – 174 GHz frequency bands for fixed links in accordance with ECC Recommendation (18)01;
- Consider amending the Radio Links Guidelines to enable longer link path lengths with lower modulation and availability requirements;
- Consider the future of the licensing of fixed links in the E-band in the Dublin area;
- Following a call for inputs on the future use of the V-band (57-71 GHz), consider implementing, if required, an appropriate licensing regime to facilitate the future use of this band;
- Consider adding a number of bands in the 5 – 30 MHz for HF fixed links to the radio link licensing list of bands; and
- Consider the publication of fixed link data on Siteviewer.

5.2.5 Licence Exempt Short Range Devices

5.11 ComReg's work plan items for SRDs for the period 2019 – 2021 are to:

- Continue to facilitate the use of SRDs to Ireland in accordance with international harmonisations measures and, where necessary, revise ComReg Document 02/71 on foot of EC and ECC harmonisation updates to facilitate the introduction of new SRDs;
- Monitor, contribute to and promote Ireland's spectrum management position in relation to IoT; and
- Monitor the outcome of CEPT studies on the feasibility of extending the use Radio Local Area Networks (RLANs) to the 5925 – 6425 MHz band for the provision of WBB services.

5.2.6 Satellite Services

5.12 ComReg's work plan items concerning Satellite Networks and Services for the period 2019 – 2021 are to:

- Continue to facilitate the licensing of satellite earth stations (SES) operating in spectrum above 3 GHz;
- Monitor compliance by MSS with CGC operators with the conditions of EC Decision 2007/98/EC; and
- Conduct a review of the existing exemption orders for Satellite Services and update, amend and/or implement new exemptions as appropriate. Subject to resourcing, consider authorising the use of SES below 3GHz during the strategy period 2019 – 2021.

90 For example, the government has signalled an intention to revise the Broadcasting Act 2009, ComReg will assist DCCAE staff as appropriate. See www.dccae.gov.ie.

5.2.7 Business Radio Services

5.13 ComReg has identified the following work plan items for Business Radio for the period 2019 – 2021:

- Conclude the consultation process on the potential award of rights of use in the 400 MHz band and, if appropriate, implement same;
- Consult on a business radio licensing regime to permit the use of national channels on a technology- and service-neutral basis;
- Monitor and contribute to the spectrum management considerations of PMSE and take appropriate actions to implement harmonisation decisions;
- Monitor, investigate and contribute to the spectrum management considerations in respect of broadband PPDR, noting that there are a number of generic BB-PPDR service provision options and harmonised frequency bands[91] [92]; and
- Relaunch the Third Party Business Radio Licensing scheme prior to the expiry of existing licences in 2021, having consulted on whether or not to keep the TPBR licensing scheme open on an ongoing basis.

5.2.8 Radio Amateur Services

5.14 ComReg's work plan item for Radio Amateur services for the period 2019 – 2021 is to:

- Consider allocating the 76-81 GHz, 134-141 GHz and 241-250 GHz bands to the Amateur Service in Ireland – which would align the Irish Table of Frequency Allocations with the European Common Allocation table and the ITU Radio Regulations.

5.2.9 Aeronautical, Maritime and Scientific Services

5.15 ComReg's work plan items concerning the Aeronautical, Maritime and Scientific Services for the period 2019-2021 are to:

- Continue to liaise with relevant stakeholders, including IAA, MRAU, Met Éireann and the Irish Defence Forces, to encourage and ensure efficient use of spectrum and to promote Ireland's interests at international fora;
- Continue to liaise and assist relevant stakeholders, including universities and other third level institutions, to encourage and ensure efficient use of spectrum and to promote Ireland's interests at international fora;
- Consider developing an appropriate licensing mechanism for apparatus used for scientific services by third level institutions; and
- Consider whether it is possible to promote and potentially establish "quiet zones" for particular frequency bands around specific areas of radio spectrum research (such as Birr Castle).

5.2.10 Defence Force Use of Spectrum

5.16 ComReg's work plan items concerning the Defence Force's use of spectrum for the period 2019-2021 are to:

- Maintain awareness of international developments, particularly in CEPT through the Civil-Military Frequency Management Forum - which brings together civil and military spectrum managers across Europe - to address issues of mutual interest;
- Continue to liaise with the Irish Defence Forces as required to resolve issues of mutual concern; and
- Explore with the relevant authorities opportunities to further enhance spectrum efficiency.

91 ECC Decision (08)05 - https://www.ecodocdb.dk/download/5e4038fd-41f1/ECCDEC0805.PDF

92 https://www.ecodocdb.dk/download/1cadc836-23e4/ECCDEC1602.pdf

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

A 1.1 The Communications Regulation Acts 2002 as amended[93] (the "2002 Act"), the Common Regulatory Framework (including the Framework and Authorisation Directives[94] as transposed into Irish law by the corresponding Framework and Authorisation Regulations[95]), and the Wireless Telegraphy Acts1926 to 2009[96] 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 ComReg recognises that the current European Common Regulatory Framework for ECN and ECS will be superseded by the EECC during the course of this forthcoming strategy period. Among other things, the ECCC will consolidate, update and replace the various directives under the existing framework (i.e. the Framework, Authorisation, Access and Universal Service directives).

A 1.4 The EECC will enter into force on 20 December 2018. Member States have two years to transpose the EECC into national law and, in that regard, ComReg expects that the DCCAE will be responsible for its transposition, and ComReg will assist as appropriate.

A 1.5 This annex is intended as a general guide as to ComReg's role in this area, and not as a definitive or exhaustive legal exposition of that role. Further, this annex restricts itself to consideration of those powers, functions, duties and objectives of ComReg that appear most relevant to the matters at hand and generally excludes those not considered relevant (for example, in relation to postal services, premium rate services or market analysis). For the avoidance of doubt, however, the inclusion of particular material in this Annex does not necessarily mean that ComReg considers same to be of specific relevance to the matters at hand.

A 1.6 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 1.7 ComReg's primary objectives in carrying out its statutory functions in the context of electronic communications are to:

- promote competition[97];
- contribute to the development of the internal market[98];

93 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.

94 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")

95 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.

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

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

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

- promote the interests of users within the Community[99];
- 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[100]; 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[101] in particular those designed to ensure effective competition[102].

A2.1.1 Promotion of Competition

A 1.8 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 1.9 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 1.10 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 1.11 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

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

100 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.

101 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).

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

- 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 1.12 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 1.13 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 1.14 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 1.15 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 1.16 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 1.17 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;[103]
- 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[104]; 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.[105]

A2.1.7 Policy Directions[106]

A 1.18 Section 12(4) of the 2002 Act provides that, in carrying out its functions, ComReg must have appropriate regard to policy statements, published by or on behalf of the Government or a Minister of the Government and notified to the Commission, in relation to the economic and social development of the State. Section 13(1) of the 2002 Act requires ComReg to comply with any policy direction given to ComReg by the Minister for Communications, Energy and Natural Resources ("the Minister") as he or she considers appropriate, in the interests of the proper and effective regulation of the electronic communications market, the management of the radio frequency spectrum in the State and the formulation of policy applicable to such proper and effective regulation and management, to be followed by ComReg in the exercise of its functions. Section 10(1)(b) of the 2002 Act also requires ComReg, in managing the radio frequency spectrum, to do so in accordance with a direction of the Minister under Section 13 of the 2002 Act, while Section 12(1)(b) requires ComReg to ensure the efficient management and use of the radio frequency spectrum in accordance with a direction under Section 13.

A 1.19 The Policy Directions which are most relevant in this regard include the following:

Policy Direction No.3 on Broadband Electronic Communication Networks

A 1.20 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 1.21 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 1.22 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

103 Section 12(3) of the 2002 Act.

104 Section 12(5) of the 2002 Act.

105 Section 12(6) of the 2002 Act .

106 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.

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 1.23 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 1.24 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 1.25 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 1.26 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 1.27 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 1.28 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 1.29 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 1.30 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 1.31 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 1.32 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 1.33 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 1.34 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 1.35 Regulation 17(8) provides that ComReg must, in accordance with Regulation 18, regularly review the necessity of t he restrictions referred to in Regulations 17(3) and 17(5) and must make the results of such reviews publicly available.

A 1.36 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 1.37 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 1.38 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 1.39 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 1.40 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 1.41 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 1.42 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 1.43 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 1.44 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 1.45 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 1.46 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 1.47 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 1.48 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 1.49 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 1.50 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 1.51 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 1.52 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 1.53 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 1.54 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 1.55 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 1.56 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 1.57 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 1.58 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 1.59 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 1.60 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 1.61 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: Spectrum Designators

A 2.1 For administrative convenience the ITU has divided the radio spectrum bands into the frequency bands[107] shown in Table 1.

A2.2 In respect of satellite communications, but not fixed links, the following band designators are commonly used as shown below in Table 2:

107 Taken from The ITU Radio Regulations 2016, Article 2, section 2.1.

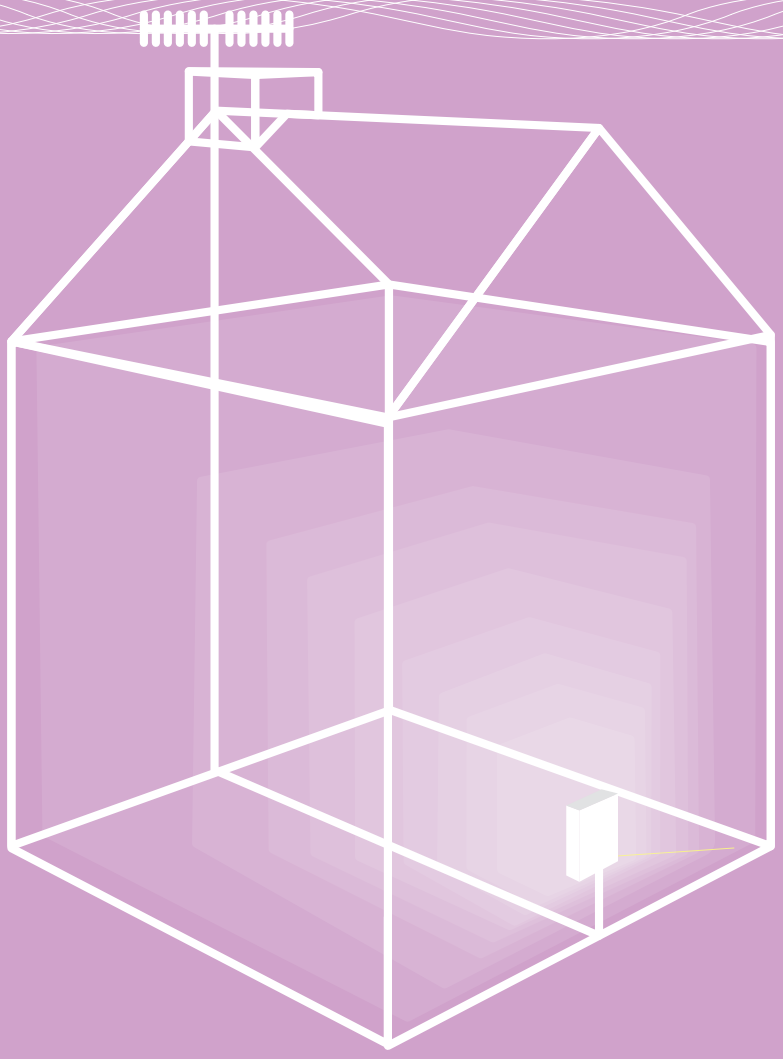
Table 1:
ITU Radio Spectrum Bands

Band Number	Symbol	Frequency Range (lower limit exclusive, upper limit inclusive)	Corresponding metric Subdivision
4	VLF	3 – 30 kHz	Myriametric waves
5	LF	30 – 300 kHz	Kilometric waves
6	MF	300 – 3000 kHz	Hectometric waves
7	HF	3 – 30 MHz	Decametric waves
8	VHF	30 – 300 MHz	Metric waves
9	UHF	300 – 3000 MHz	Decimetric waves
10	SHF	3 – 30 GHz	Centimetric waves
11	EHF	30 – 300 GHz	Millimetric waves
12		300 – 3000 GHz	Decimillimetric waves

Table 2:
Satellite band designators

Band Designator	Frequency Range
P-band	0.23 – 1 GHz
L-band	1 – 2 GHz
S-band	2 – 4 GHz
C-band	4 – 8 GHz
X-band	8 – 12 GHz
KU-band	12 – 18 GHz
K-band	18 – 27 GHz
KA-band	27 – 40 GHz
O-band	40 – 50 GHz (also known sometimes as Q-band)
V-band	50 – 75 GHz

Mobile Phone Repeaters FAQs



What is a Mobile Phone Repeater?
A mobile repeater is an electronic device that is used to improve indoor coverage of mobile phone services like calls, texts and data.

Who are these devices for?
These devices are ideal for people with poor indoor reception.

Why has ComReg legalised some Mobile Phone Repeaters?
There is a perception that indoor coverage has deteriorated despite the on-going improvements to the mobile networks by the mobile operators. Following a public consultation last year ComReg decided to make certain mobile phone repeaters licence-exempt as a potential solution to improve indoor reception.

How do they work?
These devices are usually in 3 parts; an external antenna similar to a TV antenna, an internal antenna that is placed inside the house and the repeater box itself, similar to a Wi-Fi modem placed in a home. The external antenna picks up the mobile phone signals outside the home then amplifies it inside the home giving the user improved indoor reception.

Where can I buy one?
There are some online retailers selling repeaters that comply with ComReg's technical conditions. A list of these manufacturers, suppliers and installers is available at comreg.ie/repeaters. ComReg will regularly review these lists to ensure that they are kept up to date.

Who can install a repeater?
There are no restrictions on who can install a repeater. The install requires placing an external antenna outside the property, this may involve the use of ladders and power tools. Knowledge on where the nearest mobile base station is for optimum setup. These can be located using ComReg's siteviewer webpage (http://siteviewer.comreg.ie/).

While the setup is relatively straight forward, ComReg strongly recommends and advises having a professional installer conduct the installation. You can find many insured and trained installers online at the Irish Satellite and Aerial Association and the National Guild of Master Craftsmen.

How much on average?
Current price range between 400 – 700 € (excl. VAT). The price of repeaters can vary depending on how many services you want to cover e.g. call & texts only, data only or calls, texts and data. ComReg advises consumers to consider their needs before making a purchase.

Do I need a licence?
No, a licence or registration is not required.

What is the difference between Boosters and Repeaters?
While many devices are advertised as mobile phone boosters or repeaters both amplify mobile phone signals. However, only certain ones meet the required technical conditions set by ComReg. Illegal devices that do not meet these conditions can cause interference to the mobile network and even other consumer devices. Illegal devices will be seized by ComReg and users may be subject to prosecution.

Boosters are usually cheap amplifiers that do not have any built in mobile network interference protection. Most Boosters also fail to comply with European Harmonised Standards and as such do not carry the CE mark.

Repeaters on the other hand, meet the required technical conditions and standards so they carry the CE mark.

How can I tell if a repeater will work for me or if I need one?
Have you got any outdoor coverage? If you have 1 or 2 bars of coverage outside your home and none inside, then the repeater will be able to take the outdoor coverage and amplify it inside your home.

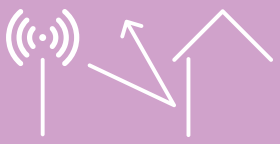
If you have no reception outside then it might still be possible for the repeater to pick up some signal using a highly directional and high gain antenna pointed at a base station. There are restrictions on the maximum power at which repeaters can transmit. In this situation it is recommended you consult with an installer.

What type of repeater do I need?
This depends on your requirements. Do you want better indoor coverage for;

Calls: If you only want to make calls then a single band GSM Repeater is what you require. This may also be advertised as a 900 band repeater, this is because the 900 MHz band is used for GSM (call/texts) in Ireland.

Data: For data a 3G (2100 MHz band) or 4G (800 MHz band) is what you require. This also depends on if 3G/4G is in your area. If you want calls & data then a multiband repeater is what you require.

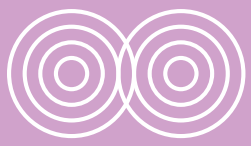
ComReg has no restrictions on the number of network operators a repeater can amplify. If the residents at a property are all on different networks then a multi-operator repeater is probably best. However if indoor reception for one operator is fine but another is weak then it may be more convenient to purchase a single operator repeater.



Why is there a difference between indoor coverage and outdoor coverage?
While operators have been expanding and optimising their networks there has been a perception that indoor coverage is getting worse. Poor indoor reception can be caused by many factors including; location, building materials, frequency band, mobile handset and even the weather can affect coverage. Mobile phone signals are radio waves that must travel from a base station through open air, around buildings, trees, mountains etc. before arriving to your home. It then has to travel through the bricks and insulation in your home and back out again to the base station. ComReg has conducted studies on the effects different building materials have on mobile phone signals and have found that certain types of energy efficient insulation and windows have a detrimental effect on signal penetration. ComReg has also conducted testing on all the currently available mobile handsets (https://www.comreg.ie/publication/mobile-handset-performance-voice/) and have found that certain phones have better antennas for making and receiving calls. This could result in one phone getting 1 or 2 bars inside a home and another getting no service.

Can 2 people make calls at the same time? What if they are on different networks?
Yes and if you have a multi-operator repeater the device will be able to handle calls on different networks at the same time.

How many phones can a repeater handle?
There is no limit on the number of phones or devices the repeater can handle. The number of phones that can make a call at any given time is down to the nearby base station. The repeater simply just amplifies the phone and base station signals.



Will a repeater cause interference?
The repeater must comply with EU standards for harmonisation so it will not cause interference.

Will it cause interference to my WiFi?
No, WiFi devices work off different frequencies to mobile phones so the repeater cannot cause interference to your home WiFi network.

Will it cause interference to my TV?
No, Digital TV and Satellite TV both work off different radio signals to mobile phones.

Will it cause interference to my wireless camera system/gates etc.?
No, Wireless cameras, doorbells, gates etc. all work off different radio frequencies to those used by mobile phones and base stations.

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