



Commission for
Communications Regulation

C O M R E G

Spectrum Management Strategy Statement

2008 - 2010

Contents

1. Foreword	3
2. Executive Summary	5
3. Introduction and Opportunities	7
3.1 ComReg's Role	7
3.2 Spectrum – Ireland's Natural Advantage	8
3.3 The Contribution of Radio Spectrum to Ireland's Economy	8
3.4 Spectrum Opportunities	10
3.5 Market Mechanisms and Spectrum Management	11
3.5.1 ComReg's Position on Auctions	11
3.5.2 ComReg's Position on Spectrum Trading	11
4. Strategy for Managing the Radio Spectrum	12
4.1 ComReg's Mission	12
4.2 ComReg's Vision and High Level Goals	12
4.3 Spectrum Management Strategy Drivers	13
4.3.1 Consumers	13
4.3.2 Innovation	13
4.3.3 Spectrum for Government Services	13
4.3.4 Spectrum for Intelligent Transport Systems (ITS)	14
4.3.5 Harmonisation of Irish Spectrum Allocations	14
4.3.6 Legal and Regulatory Environment	14
4.4 Spectrum Strategy Supporting ComReg's High Level Goals	15
4.4.1 Spectrum Strategy in Support of Consumers	15
4.4.2 Spectrum Strategy in Support of Competition	16
4.4.3 Spectrum Strategy in Support of Innovation	17
4.4.4 Spectrum Strategy in Support of the Organisation	17

1. Foreword

The radio frequency spectrum is a unique, finite, natural resource from which many aspects of society derive benefit.

These benefits are accrued by a range of private, commercial, consumer, defence, security, scientific and public safety applications that have access to spectrum; the only resource that can support wireless communication technologies.

The wireless telecommunications sector plays an important role in the Irish economy. Over 30 000 people are directly employed in the sector and at a conservative estimate, the economic contribution of the radio sector in 2006 amounts to approximately €3 billion. This is equivalent to 1.67% of total GDP for that year.

The Commission for Communications Regulation (ComReg) is responsible for the efficient management and use of this key natural resource, the radio spectrum. The efficient and effective management of the spectrum encourages the promotion of competition including cross-platform competition. Competition is a vital element of effective regulation as competition is fundamental to providing consumer choice and innovative products. Effective competition in the communications sectors leads to consumers ultimately reaping the benefits of greater choice, higher quality and lower prices.

ComReg is recognised internationally as an innovator in the use of radio spectrum and, through its previous actions in this domain, how the management of radio spectrum can drive innovation. In this document ComReg sets out its strategy for managing the use of the radio spectrum in Ireland from 2008 to 2010 in order to ensure that the maximum strategic, economic and social benefits can be leveraged from use of the radio spectrum by end users. In implementing this strategy to 2010 ComReg will take full account of national spectrum policy.

The pace of global economic growth in wireless technologies and services imposes increased demands on the resource and as communications increasingly become mobile, these demands are set to increase. During the life of this plan we expect to see new and innovative spectrum deployments in many areas including the liberalisation of GSM spectrum, the licensing of Digital Terrestrial Television (DTT) across Ireland and furthering the debate around the potential of the ensuing Digital Dividend and how this should best be utilised to the benefit of all end users.

Other key areas to be addressed in the period to 2010 include the release of additional spectrum below 4 GHz to meet wireless broadband access and multimedia mobile services and the provision of spectrum for a modern digital radiocommunications emergency services network.

The draft spectrum management strategy statement, document 08/20¹, was published for consultation in March 2008 and we received twenty four responses to that consultation by the closing date. I am delighted by the generally positive and constructive nature of the responses. Reflecting the broad scope of the consultation document, respondents focused on many different areas, providing valuable insight to the various sectors and highlighting their preferences for the way ComReg should prioritise its work programme over the next two years.

This strategy statement is the third such document following on ComReg's corporate strategy statement² and the Postal Strategy Statement³ which were published earlier.

In general, respondents to the draft strategy were in favour of ComReg's approach to licencing on a technology neutral and service neutral basis. Respondents also put forward a number of suggestions on how we might achieve the specific goals we have declared and in what areas we need to provide additional clarity on what we are proposing to do.

Two key areas on which additional clarity was requested concern our intentions around the 2.6 GHz spectrum band and in the area of the Digital Dividend. In both these areas clear statements of ComReg's intentions over the duration of this strategy are provided.

In the time between the publication of the Draft Spectrum Strategy and this Strategy Statement, demonstrating the pace of progress in this area, two interesting developments have taken place.

Firstly, ComReg has published details⁴ on how it will regulate Mobile Communications on Aircraft, that is the use of personal communications equipment during the 'in flight' phase of a journey as well as the facilitation of the use of this service on aircraft flying over Irish airspace and registered in other jurisdictions. Secondly, ComReg has completed a very successful award process at 26 GHz where 13 licences for national spectrum have been awarded to 5 operators.

The award process enabled the market to determine the amount of spectrum that would be managed by operators and the amount retained by ComReg for individual licencing; as well as determined the split between point-to-point and point-to-multipoint technology usage in the band.

ComReg is committed to encouraging further competition and supporting innovation throughout the life of this plan. In this regard our approach is to regulate only where required and to intervene only where necessary to promote competition and innovation or to avoid harmful interference.

Mike Byrne
Commissioner

1. ComReg document 08/20, "Proposed Strategy for managing the radio spectrum: 2008 – 2010, an assessment of the economic impact of spectrum usage and a proposed strategy to manage the radio spectrum in Ireland", Published 6 March 2008 and available on www.comreg.ie
2. ComReg document 07/ 104 - Strategy Statement (2008 – 2010) – published 17 Dec 07
3. ComReg document 08/17 – Postal Strategy Statement (2008 – 2010) – published 15 Feb 08
4. ComReg Document 08/36a, "Information Notice: Mobile Communication Services On Aircraft ", published on 23 May 2008 and available on www.comreg.ie.

2. Executive Summary

The radio frequency spectrum provides the means to convey audio, video and other content over distances ranging from a few metres to thousands of kilometres.

Radio spectrum is essential for the continuing provision of ubiquitous mobile communications and to provide wireless reception of broadcast services.

It is also fundamental to the safe operation of air and maritime transport, used widely by the defence forces, emergency services and supports many important scientific applications.

The period to 2010 promises a number of changes in the deployment and use of spectrum. This document sets out ComReg's strategy for managing the use of the radio spectrum in Ireland over this term in order to ensure that Ireland can, in this context, leverage the maximum benefits economically, strategically and socially from use of the radio spectrum.

ComReg has reviewed the economic contribution made by the use of radio spectrum to the Irish economy and estimates that the contribution for 2006 is almost €3 billion. This is equivalent to 1.67% of total GDP. The number of direct employees whose jobs are dependent on use of the radio spectrum is conservatively estimated to be in excess of 30,000.

In preparing this strategy ComReg has identified six key drivers. These are:

- (i) The demand from wireless Consumers for all their business and entertainment requirements to reach them on one single device in any location.
- (ii) Innovation demands for suitable spectrum in order to establish new wireless electronic communication services.
- (iii) The imminent establishment of new Government Services (emergency and public safety networks) is driving demand for unused spectrum.
- (iv) To Harmonise Irish Radio Spectrum with European and International spectrum allocations to accrue the benefits of alignment with larger market economies.
- (v) Significant changes are expected in the European regulatory framework for electronic communications affecting the Legal and Regulatory Environment in which ComReg operates.
- (vi) In line with European initiatives Ireland is employing Intelligent Transport Systems which will require appropriate spectrum and a licensing framework in the near future.

In its recent corporate strategy publication⁵ ComReg set out its four broad objectives, all of which are core to the development and use of spectrum:

- To ensure all **consumers** are appropriately informed and protected⁶;
- To create the conditions for **sustainable**, dynamic and innovative competition in the sectors we regulate;
- To promote **innovation** in converging platforms and technologies by creating a supportive and predictable regulatory environment;
- To be a **professional, innovative organisation** that is a leading source of expertise in the communications sector.

On the basis of **likely demands** for spectrum and changes in the legal and regulatory environment resulting from the six drivers and to support ComReg's corporate strategy, a number of broad radio spectrum management strategies have been developed. These are set in greater detail at Section 6. These broad strategic goals are further reflected in **specific actions** that have been identified for each of the various users of spectrum as outlined in Section 7.

The key tasks facing ComReg in the next two years include:

1. The liberalisation of the GSM Spectrum bands to facilitate the growth of the public mobile services and innovation through the use of 3G and other technologies in these bands.
2. The licensing of Digital Terrestrial Television across Ireland and facilitating access to the ensuing Digital Dividend once all relevant legislative obligations have been achieved.
3. The provision of spectrum for public safety and emergency services in support of a Government tender for a modern digital radiocommunications network.
4. The release of substantial additional spectrum below 4 GHz, to meet market demand and to support the expected requirement for additional spectrum to facilitate broadband and multimedia mobile services.
5. Responding to the introduction of a modified European regulatory structure for electronic communications services and networks⁷.

The synopsis of this document is as follows:

- Section 3 summarises ComReg's role as spectrum manager, spectrum as Ireland's advantage and the use of the test and trial scheme to encourage innovation. Showing the importance of managing this natural resource, this section also details the economic and social impact that the use of spectrum has in Ireland. A summary list is provided of the frequency bands that have been identified, following expressions of interest, for release in the next two years.
- Section 4 lays out ComReg's mission, vision and high level goals which together with six identified strategy driver underpins ComReg's spectrum strategy statement.
- Section 5 details a strategy/action plan covering the next two years for each service that ComReg regulates.
- The regulatory framework that ComReg operates under and the names of the responders to this consultation are provided in the annex to this document.

5. Document ComReg 07/104, "Strategy Statement (2008-2010)."

6. Within the context of this strategy, industry is treated as a consumer of spectrum.

7. The main emphasis of this framework is the promotion of competition and a single European market in electronic communications. This framework is currently under review with the aim of introducing the revised legislation in the EU by 2008 followed by implementation in Member States by 2009-2010. The review is focusing on flexible spectrum management, streamlining market reviews, consolidating the internal market, strengthening consumer protection and user rights, improving security and removing outdated provisions.

3. Introduction and Opportunities

Management of the radio spectrum involves the careful combination of administrative, regulatory and technical procedures necessary to ensure the efficient operation of radiocommunication equipment and networks.

A primary goal of spectrum management is to ensure optimal use of the radio spectrum, having regard to social, economic and technical considerations.

In managing the radio spectrum, ComReg must balance a range of often competing factors. These include:

- ensuring that ComReg meets the requirements of all radio services and that there is a balance between commercial and public policy requirements;
- maximising social benefits arising from radio use, for example in relation to public safety, national security and health care; and
- enhancing Ireland's competitiveness by ensuring that adequate spectrum is allocated and assigned to users that derive the highest economic value from it.

In addition, there is a need to ensure the efficient use of the spectrum within the bounds of spectrum constraints and technology developments. The regulatory process of ensuring the optimal use of the spectrum needs to be flexible and responsive in order to adapt to changes in technologies, demand, markets and public policy.

3.1 ComReg's Role

ComReg is the National Regulatory Authority (NRA) responsible for the regulation of the electronic communications sector (telecommunications, radiocommunications and broadcasting⁸ transmission) in Ireland. In carrying out its role in relation to radio spectrum management ComReg must, amongst other things:

- ensure that measures taken are proportionate in ensuring the efficient management and use of the radio spectrum; and
- have regard to international developments with regard to the radio frequency spectrum.

The process of allocating frequencies to radio services and the regulatory framework are largely determined by external factors such as public policy, legislation and international agreements or regulations. Public policy goals play a significant role in determining spectrum management priorities. Technical efficiencies may have to be compromised in order to safeguard the provision of certain public services such as safety, defence and public broadcasting services. Technical and economic efficiencies may also be constrained by international obligations related to spectrum use, especially restrictions on the amount of power that can be exported across national borders.

ComReg plays an active role, along with the Department of Communication, Energy and Natural

8. In relation to broadcasting ComReg's role is limited to spectrum management and assignment issues. Broadcast policy is decided by the Minister for Communications, Energy and Natural Resources and content issues are regulated by the BCI and the RTE Authority.

Resources (DCENR), in international fora to ensure that as far as possible the international allocation and regulatory framework accommodates Ireland's specific requirements.

ComReg also participates in technical compatibility studies and in the development of technical standards to support more efficient and flexible use of the spectrum. ComReg monitors licensed operators to ensure that they are in compliance with their licence conditions and investigates complaints of interference. ComReg is also obliged to ensure that all radio equipment placed on the market is in compliance with the R&TTE⁹ and EMC¹⁰ Directives. ComReg also monitors the radio spectrum to ensure that there are no unlicensed operators and takes appropriate enforcement action against any person or business found unlawfully operating a radio system without a licence.

3.2 Spectrum – Ireland's Natural Advantage

Ireland's geographic position on the western edge of Europe and low population density provides a key natural advantage, namely, that there is a relative abundance of unused spectrum. This includes unused spectrum in a number of frequency bands ideally suited to new wireless technologies in the mobile and broadband wireless access space.

In response to market demands and to encourage and maximize the use of radio spectrum for the benefit of industry and research institutions in Ireland, ComReg launched a substantially enhanced Test and Trial wireless scheme in 2005 to take advantage of the unused spectrum. The revised licence scheme allows innovators to carry out tests and trials of wireless technologies in a live environment.

Such tests can facilitate the development of new systems which are not yet fully standardised or the manufacture of systems destined for deployment in foreign markets, where different standards and regulations may apply. Trials of wireless systems allow the industry to garner consumer feedback in a live trial environment prior to commercial launch. Ireland's abundance of uncongested spectrum allows ComReg to accommodate requests for any frequency bands not currently being used in a particular location for test licences, including parts of the mobile and broadcasting bands. ComReg believes that more can be done to reinforce Ireland's position

as a premier location of choice for research and development (R&D) in the use of spectrum and the establishment of R&D facilities in Ireland to further this work. As part of its strategy, ComReg will work with other state agencies, Government, commercial organisations and third level institutions to develop its goals in this key area.

3.3 The Contribution of Radio Spectrum to Ireland's Economy

A key consideration in developing a strategy for radio spectrum management is the extent to which use of the radio spectrum contributes to the Irish economy, national competitiveness and increased cross platform competition in the market. Ultimately, innovation in the use of radio spectrum will provide the potential for enhanced choice, improved service quality and lower prices for all consumers.

Research carried out by ComReg, based on publicly available data, estimated that the total contribution to Irish GDP arising from the use of radio spectrum in 2006 was nearly €3 Billion, or approximately 1.67% of that year's total GDP. Spectrum's contribution to the economy has grown substantially over the last 4 years, both in absolute terms, and as a relative share of the economy, even though this was a period of high general economic growth. Between 2003 and 2006 years, the annual rate of growth of spectrum's contribution was 14.1%, while the rate of growth of GDP was 6.1%. Thus, even during a period extremely rapid economic growth, spectrum grew even faster and remains an important part of the economy.

Spectrum is also a significant and growing source of employment; a conservative estimate of the number of employees in Ireland whose jobs are dependent on the use of radio spectrum was over 30,000 in 2006¹¹.

These figures highlight the importance of radio spectrum to the Irish economy. The social benefits arising from use of the radio spectrum are also considerable. Efficient functioning of the Gardaí, fire and ambulance services, for example, depends on reliable mobile communications, while radio plays a major role in enabling the Irish Defence Forces to carry out their duties both at home and overseas. The value of broadcasting goes far beyond its economic contribution in terms of fostering civil society, its cultural significance, its role in media pluralism and hence its importance as a public policy objective.

9. The R&TTE Directive refers to Article 3(2) of Directive 1999/5/EC of The European Parliament and of The Council of 9 March 1999 On Radio Equipment And Telecommunications Terminal

10. Equipment and the Mutual Recognition of Their Conformity O.J. 7.4.99 L 91/10.

The EMC Directive refers to Council Directive 2004/108/EC of 15 December 2004 on the approximation of the laws of Member States relating to electromagnetic compatibility O.J. L 390/24.

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

3. Introduction and Opportunities continued

Radio is fundamental to the safe operation of air, sea and land transport. Additionally, Ireland plays a critical role in managing international radio traffic in the aeronautical sector, dealing with all flights between Europe and North America. Thus it is clear that the contributions of the defence, public safety, transport and broadcasting sectors to society and the economy is heavily dependent on access to radio spectrum. The methodology used to calculate the contribution of radio spectrum is given in annex C.

The following tables show the estimated contribution to GDP (Table 1) and employment for each of the main uses of radio spectrum (Table 2)¹².

Table 1: Summary of GDP Contribution

GDP (€m)	2002	2003	2004	2005	2006
Mobile	491	716	919	869	1410
Broadcasting	293	332	294	297	283
Fixed links ¹³	n/a	n/a	4	2	13
Air services	331	373	535	744	706
Low Power Devices	575	530	495	481	399
Other Services	4	2	4	4	7
Sub Total	1634	1953	2251	2397	2758
GDP	130215	139413	148502	161498	165047
% of total economy	1.25	1.40	1.52	1.48	1.67

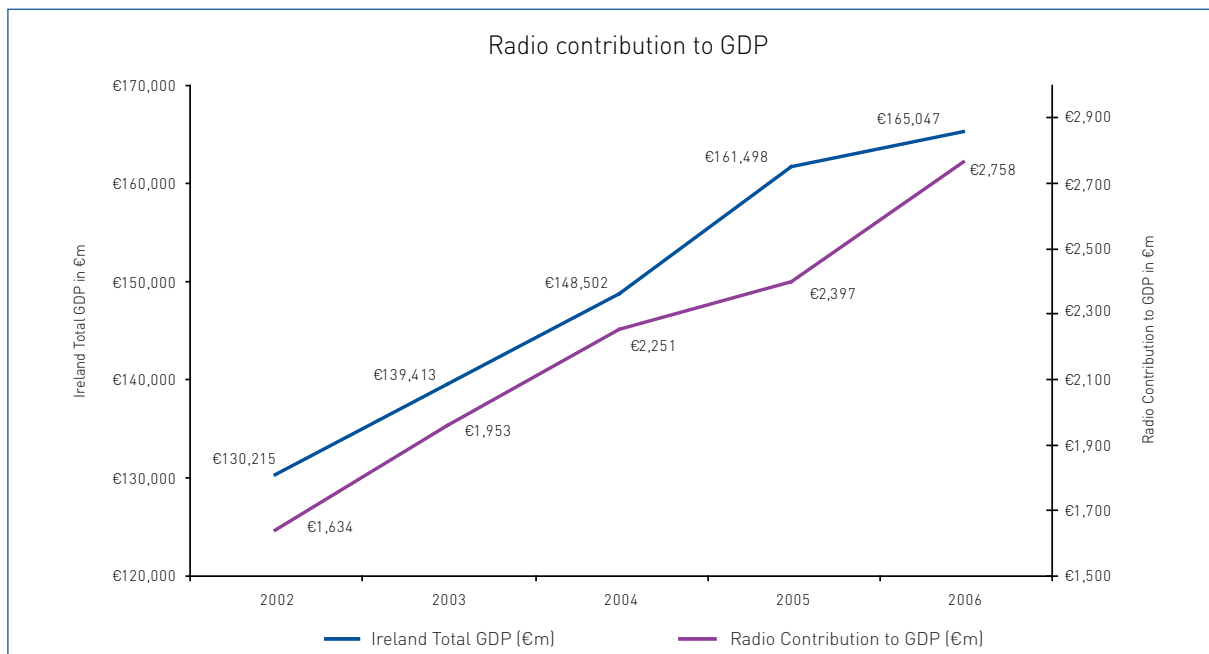
Figure 2 below illustrates the relationship between Ireland's total GDP in years 2002 to 2006 with the aggregate contribution of the radio sector over the same period. In real terms growth has increased on average approximately 17.2% annually. The contribution of radio services has continued to track the proportionate increase in economic growth within the Irish economy over the last five years. The correlation illustrated by the graph below is suggestive of the value in terms of cost and efficiency that is accompanied by enhanced telecommunications capacity.

In Table 2, below, the employment effects were estimated directly where suitable data was available, for example from annual reports. An economic multiplier of 1.1 was used in this context (See annex C).

Table 2: Summary of employment impacts

Employment	2002	2003	2004	2005	2006
Mobile	6404	6056	5215	5768	6168
Broadcasting	4510	4553	4803	4931	4710
Fixed links			98	89	389
Air services	11978	11829	12174	14595	15986
Low Power Devices	2547	2633	2884	3449	3012
Other Services	23	75	74	80	127
Total	25462	25146	25248	28912	30392

Figure 1: The radio sector's contribution to Irish GDP¹⁴



12. Data for maritime services was not included as it is not possible to determine with a reasonable degree of confidence, the extent to which these depend on radio (unlike aeronautical services, most maritime activities could be undertaken without radio spectrum, albeit with reduced efficiency and safety).

13. Fixed link figures exclude infrastructure links for mobile and broadcast networks which are included in those sectors. Estimates are based on number of licensed links and typical maintenance costs.

14. While a perfectly linear and parallel correlation cannot be expected in estimations of this order, GDP in Ireland was somewhat above its trend growth in 2005. This is perhaps attributed to factors such as unusually high growth in another sector within the economy such as construction. It should also be noted that changes in the communications sector such as mergers and acquisitions can affect how financial data is reported. These changes may not be fully captured by the methodology as adopted.

3.4 Spectrum Opportunities

This section provides a summary list of the frequency bands in which ComReg intends to make spectrum available over the next two years. There are a number of factors beyond ComReg's control, including technological change and demand, results of public consultations and finalisation of Government policy that can affect the release of spectrum.

The information in this section should be used as a guide only and nothing in this section should be taken to bind ComReg to any course of action in later processes. While ComReg has made a best

endeavour to identify potentially useful frequency bands which demand has indicated is required for future assignment, the absence of any specific band in this document or this section in particular should not be taken to indicate that such a band will not be considered for allocation or assignment in the future or during the period covered by this strategy.

ComReg continues to monitor spectrum demand, regional, international and commercial developments and may seek to make other bands available should future circumstances warrant such a course of action.

Table 3: Indicative guide to Spectrum Opportunities in Ireland (2008-2010)

Spectrum Band	Action / Timing of Release	Notes / Process
169 MHz	Updating of Business Radio Guidelines to include paging and other services in this band – Q408 Adding Short Range Devices to exception order – Q408	Harmonised European Band. EC Decision 2005/928/EC applies. See Section 5.10
Interleaved UHF Spectrum	Consultation underway on licence conditions which could be applied to mobile TV. Licence Competition planned following completion of consultation.	Release of spectrum @ 500 MHz. See Section 5.3
925 – 960 MHz paired with 880 – 915 MHz	Consultation on the liberalisation of the 900 MHz GSM Band – July 08 Note: 925 – 937.8 MHz / 880 – 892.8 MHz band is currently unassigned Licence Competition planned following completion of consultation.	Currently allocated to GSM only, a draft EC Decision proposes to remove this restriction. See Section 5.2
1452 – 1492 MHz	Not under consideration for release in the life time of this strategy.	Insufficient demand
1805 – 1880 MHz paired with 1710 – 1785 MHz	Consultation on the liberalisation of the 1800 MHz GSM Band – July 08 Note: 1805–1831 MHz / 1710–1736 MHz and 1875–1880 MHz / 1780–1785 MHz band is currently unassigned. Licence Competition planned following completion of consultation.	Currently allocated to GSM only, a draft EC Decision proposes to remove this restriction. See Section 5.2
1915 – 1920 MHz	Not under consideration for release in the life time of this strategy.	Insufficient demand
2010 – 2025 MHz	Consultation planned for early 2010. Licence Competition planned following completion of consultation.	Some interest in band expressed See Section 5.2
2300 – 2400 MHz	Investigate further the options for use of the band 2300-2400 MHz in the context of related demands on spectrum in other bands. Consultation planned for late 2008.	Strong interest expressed to open this band. See Section 5.1
3500 – 3510 MHz	For consideration following the conclusion of the Government National Broadband Scheme tender, if not utilised by the winner of that tender.	BWA spectrum set aside, for the use of the winner of the National Broadband Scheme.
3660 – 3710 MHz	Information notice releasing this spectrum under FWALA in Q308 Start of Licence Competition to be notified in information notice.	Strong interest expressed to open this band. See Section 5.5
3760 – 3800 MHz	Information notice releasing this spectrum under FWALA in Q308 Start of Licence Competition to be notified in information notice.	Strong interest expressed to open this band. See Section 5.5
26 GHz	Competition completed in June 2008	Further details available on ComReg Website ¹⁵ .
28 GHz	Timing of release and licence award methodology under consideration to be opened.	Interest expressed for future fixed link bands See Section 5.4
31/32 GHz	Timing of release and licence award methodology under consideration to be opened.	Interest expressed for future fixed link bands See Section 5.4

15. See http://www.comreg.ie/radio_spectrum/26ghz_spectrum_competition.691.html

3. Introduction and Opportunities continued

3.5 Market Mechanisms and Spectrum Management

In recent years there has been increasing international interest in the application of market based approaches to spectrum management, with the objective of increasing flexibility and promoting more economically efficient use of radio spectrum. The two principal market based mechanisms that have been applied are auctions and secondary trading. Auctions have been used as an alternative to comparative selection procedures for awarding rights to use radio spectrum where the number of rights available is limited. Secondary trading allows spectrum rights to be traded between entities, providing a means of accessing radio spectrum via the market rather than the regulator¹⁶.

3.5.1 ComReg's Position on Auctions

ComReg does not at this stage favour any specific approach for awarding spectrum rights, but prefers to consider each award on its own merits. In making such an assessment ComReg balances the size and scale of the Irish market, public policy considerations, social considerations, economic and market considerations, legal factors and expected demand and use in order to determine the most appropriate allocation method to deliver an efficient outcome.

In recent years ComReg has developed new licensing regimes based on first-come-first-served (e.g. FWALA), comparative selection (beauty competitions, i.e. the fourth 3G licence) as well as auctions (e.g. the All-Island Spectrum award). Auctions have proved to be a quick, fair and transparent method for assigning frequencies. As a result auctions are the preferred assignment method where the demand for spectrum exceeds its supply. Underpinned by a technology neutral-approach and, where appropriate, by a service-neutral approach, auctions are proving to be successful in facilitating the promised introduction of new services and greater competition in the market. Where auctions have been used ComReg has purposefully used a simple auction process, the first- or second-price single-sealed bid format. However, the use of auctions in Ireland for spectrum allocation is changing as markets evolve. Recently a second-price single sealed-bid approach was used to assign the All-island spectrum licence.

As spectrum demands evolve and increase it is conceivable that in the lifetime of this strategy statement that ComReg may hold its first simultaneous multiple round auction (SMRA).

3.5.2 ComReg's Position on Spectrum Trading

There are a number of studies discussing the potential benefits to greater liberalisation and, in particular, of introducing trading of spectrum rights. A major study commissioned by the European Commission (EC)¹⁷ determined that at a conservative estimate, the EU could gain by at least €9bn per year as a result of introducing liberalisation.

ComReg has considered the potential benefits of spectrum trading for specific licence categories and has concluded that secondary markets could potentially play a role in ensuring the efficient assignment and use of the spectrum in some areas. However, it is recognised by all stakeholders that the use of spectrum trading (and other innovations in the development of rights of use) needs to be underpinned by a revision of existing primary legislation.

16. Although the regulator still has a role to ensure that the spectrum continues to be used in an appropriate manner.

17. Study on conditions and options for introducing secondary trading of radio spectrum in the European Community, by Analysys Consulting Ltd, DotEcon Ltd and Hogan & Hartson LLP.

4. Strategy for Managing the Radio Spectrum

Under the Communications Regulation Act 2002 ComReg is required to ensure the efficient management and use of the radio frequency spectrum in Ireland. In this regard ComReg publishes every two years, a Strategy Statement for the electronic communications sector.

ComReg's current Strategy Statement¹⁸ is a forward-looking document that serves as a framework for action by the organisation for the period 2008-2010. It sets out ComReg's plan for the delivery of identified key priorities and forms the foundation for this document focusing on the Spectrum Strategy for the same period.

4.1

ComReg's Mission

ComReg enables the development of a sustainable, competitive and dynamic communications sector in Ireland and empowers consumers to make informed choices.

The management of the radio spectrum is one of the enablers of this mission. The use of spectrum is intrinsic to the sustainability of the communications sector. Making spectrum widely available increases competition. Technology neutrality is one way of increasing flexibility and increasing the dynamism of the sector.

4.2

ComReg's Vision and High Level Goals

ComReg's vision for the electronic communications sector entails facilitating the conditions for sustainable, dynamic and innovative competition to exist in the sectors we regulate and for all consumers to be appropriately informed and protected and to have easy access to an increasingly wide range of competitively-priced quality products and services.

Our vision is of ComReg promoting innovation in converging platforms and technologies by creating a supportive and predictable regulatory environment that facilitates convergence and which enables industry and other stakeholders to make informed decisions on future investment, roll-out and deployment of new technologies.

To ensure achievement of our vision, ComReg is a professional, innovative organisation that is acknowledged as a leading source of expertise in the electronic communications sector.

18. Document ComReg 07/104, "Strategy Statement [2008-2010]."

4. Strategy for Managing the Radio Spectrum continued

In moving towards this vision ComReg established the following four high level goals:

- To ensure all consumers are appropriately informed and protected and have easy access to a wide range of competitively-priced quality products and services.
- To create the conditions for sustainable, dynamic and innovative competition in the sectors we regulate, which delivers a choice of high quality products and services at competitive prices to consumers.
- To promote innovation in converging platforms and technologies by creating a supportive and predictable regulatory environment which enables industry and other stakeholders to make informed decisions on future investment, roll-out and deployment of new technologies.
- To be a professional, innovative organisation that is acknowledged as a leading source of expertise in the communications sector.

4.3 Spectrum Management Strategy Drivers

As all wireless communication technologies require access to radio spectrum, and as the demands for these technologies rise, so too will demands to access the radio spectrum. The technological uses of spectrum are both varied and wide-ranging and extend from entertainment, leisure and consumer products to education, health and public safety.

Demand is difficult to predict in an era of rapid technological development. There is however, little doubt that demand for spectrum will continue to increase, and that its management will become increasingly nuanced. The ready availability of spectrum has prevented, in most areas, any excess demand issues arising. But, greater consideration may have to be given to competition as the growth of consumer markets and new technologies place pressure on the remaining spectrum available.

ComReg has identified **six key drivers** which are likely to have a significant impact on demand for spectrum and have informed ComReg's strategy for managing the radio spectrum over the next two years. These six drivers are addresses in turn below.

4.3.1 Consumers

Consumers of communications services demand access with few if any restrictions on location or time when the services are available. To meet this demand industry is moving to supply more of what were traditionally seen as fixed services (e.g. broadcasting, broadband, etc) to a mobile platform.

Also, consumers increasingly expect to receive all their business and entertainment requirements through a single device/handset. Meeting this demand for multimedia content will require a considerable increase in the availability of radio bandwidth.

Both of these consumer demands are key drivers in the convergence¹⁹ between the three traditionally separate areas of fixed, mobile and broadcasting services.

4.3.2 Innovation

Existing operators and licensees, as well as potential market entrants and entrepreneurs, typically seek to gain market share or develop new businesses by leveraging innovation to differentiate products or services. Creating a regulatory environment supportive of innovation in new electronic communications services is critical in realising the benefits of a vibrant telecommunications industry and this philosophy underpins much of ComReg's approach to spectrum management.

4.3.3 Spectrum for Government Services

Future requirements for security and public safety related radiocommunications always needs to be considered as part of any spectrum strategy. In the lifetime of this strategy, the licensing of new digital technologies for these services is expected. This includes the licensing of new services in unused spectrum set aside for the emergency services for example, Emergency TETRA at 380-400 MHz. This should then naturally lead to the release of existing spectrum used for analogue technology by these services in the VHF and UHF bands, potentially for commercial use. The growing use of CCTV and surveillance technologies in the support of security and policing actions is also likely to require the use of higher frequency bands which can support the broadband communications links required.

19. Convergence in this context is the deployment of multiple digital media such as broadcasting, telecommunications and information technology to deliver integrated multimedia content and services.

4.3.4 Spectrum for Intelligent Transport Systems (ITS)

Road safety remains a major concern across Europe where in 2005; road accidents killed over 40,000 people in the European Union and injured more than 1.2 million. In Ireland 333 people died on the roads in the twelve months from the end of June 2006 to June 2007, an average of 28 fatalities per month.²⁰

Integrated safety systems, which use information and communication technologies in intelligent solutions, are being developed by the automotive industries in order to improve road safety and reduce the number of accidents on Europe's roads. Across Europe there has been significant activity on the development of ITS which is placing demands on access to radio spectrum in order to accelerate the deployment of these systems and the European Commission mandated CEPT to identify appropriate spectrum in support of ITS. In Ireland, the Department of Transport has published a consultation about the development of Intelligent Transport Systems (ITS).²¹

4.3.5 Harmonisation of Irish Spectrum Allocations

Ireland has a highly developed economy and is a large user of communications technology per capita. While Ireland does not manufacture large quantities of radiocommunications equipment, its consumers are viewed internationally as 'early adopters' of new communications technologies. Ireland's geography and demography make it uniquely suitable as a test bed for the deployment of innovative communications technologies. In order to maximise these benefits allocation of the radiofrequency spectrum needs to be particularly cognisant of market developments both in Europe and internationally.

4.3.6 Legal and Regulatory Environment

Ireland's legislative framework for wireless services has within the past 5 years largely been shaped from the EU level through the introduction of the EU Regulatory Framework for Electronic Communication. The main emphasis of this framework is the promotion of competition, the move towards WAPECS²² and the introduction of a single European market in electronic communications. This framework is currently under review with the aim of introducing the revised legislation in the EU by 2008 followed by implementation in Member States by 2009-2010. The review is focusing on the following principles:

- Flexible spectrum management (introducing WAPECS).
- Streamlining market reviews.
- Consolidating the internal market.
- Strengthening consumer protection and user rights.
- Improving security.
- Removing outdated provisions.

At a national level, it is anticipated that within the next 2-5 years new legislation relating to the regulation of the electronic communications sector will be introduced. These include a new Radiocommunications Act, which will replace the Wireless Telegraphy Acts 1926-1988, as well as a new Broadcasting Act.

20. Road Safety Strategy 2007 -2012, Road Safety Authority, www.rsa.ie

21. Consultation Paper on Intelligent Transport Systems, March 2006, <http://www.transport.ie/viewitem.asp?id=7365&lang=ENG&loc=1512>

22. WAPECS is a framework for the provision of electronic communications services within a set of frequency bands to be identified and agreed between European Union Member States in which a range of electronic communications networks and electronic communications services may be offered on a technology and service neutral basis, provided that certain technical requirements are met, i.e., to avoid interference, to ensure the effective and efficient use of the spectrum and the authorisation conditions do not distort competition. See section 5.1 – WAPECS – Wireless Access Policy for Electronic Communications Services for further information.

4. Strategy for Managing the Radio Spectrum continued

4.4 Spectrum Strategy Supporting ComReg’s High level Goals

To assist in achieving ComReg’s high level goals and having regard to the six strategy drivers specific to spectrum, ComReg has developed the following broad radio spectrum management strategies.

4.4.1 Spectrum Strategy in Support of Consumers

High Level Goal

To ensure all consumers are appropriately informed and protected and have easy access to a wide range of competitively-priced quality products and services.

1. In support of the industry responding to consumer demands

Strategies

- Implement technology neutral licence conditions as far as practicable recognising ComReg’s role in preventing harmful interference to co- and adjacent-channel users.
- Implement service neutral licence conditions as far as practicable given international agreements, European legislation, the requirement to limit harmful interference, support of national policy and operating in the best interests of consumers.
- Release additional spectrum below 4 GHz²³, to meet market demand, to support the expected requirement for additional spectrum to facilitate broadband and multimedia mobile services. In doing so, to utilise appropriate market mechanisms when assigning available spectrum that allows prospective licensees the opportunity to acquire only the spectrum they deem necessary.

2. In support of the industry as a consumer of Spectrum

Strategies

- Supply information in the form of this strategy, the radio frequency plan, comprehensive consultations, industry fora, seminars and workshops.
- Use market mechanisms where demand exceeds supply to ensure the most efficient user acquires spectrum.
- Having full regard to national spectrum policy, take into account the interests of all users of the radio spectrum, i.e. both ECS and non-ECS spectrum users.
- Consider the further use of incentive pricing to stimulate technologically efficient use of spectrum and promote the release of underutilised spectrum.
- Remove barriers to convergence by working to improve legislation so as to facilitate convergence across sectors.
- Continue to ensure that appropriate spectrum continues to be available to meet the needs of public safety, emergency services, safety of life services and the defence forces in view of their vital role in the safeguarding of human life, property and national security.
- Make access available to harmonised spectrum to facilitate Intelligent Transport Systems in Ireland.
- Seek to harmonise the use of spectrum in Ireland with international and European allocations to leverage the effects of standardization that result when a number of markets utilise a common technology.

23. Spectrum below 4GHz is preferred for mobile services due to its superior propagation, coverage and penetration characteristics.

3. In direct support of Consumers

Strategies

- Protect consumers by ensuring that licensed and licence-exempted services fully meet all licence conditions and international standards.
- Ensure that consumers are guaranteed a minimum Quality of Service (QoS) from network operators by conducting drive tests and QoS survey programmes.
- Deal promptly with cases of non-compliance and, using all legal and regulatory tools at ComReg's disposal, take appropriate action against non-compliant equipment found on the Irish market. Ensure safety-of-life services are always given the highest priority.
- Actively participate in European-wide cross-border market surveillance campaigns with the aim of ensuring that the radio spectrum is maintained in a state fit for use by industry and consumers in conformity with the R&TTE Directive. This includes liaison with the National Consumer Agency (NCA) which is responsible for co-ordinating Ireland's RAPEX²⁴ activities.

4.4.2 Spectrum Strategy in Support of Competition

High Level Goal

To create the conditions for sustainable, dynamic and innovative competition in the sectors we regulate, which ultimately delivers a choice of high quality products and services at competitive prices to consumers

4. In providing opportunities for competition

Strategies

- Ensure flexibility and ease of access to radio spectrum in order to accommodate technological advances and market factors in order to leverage Ireland's competitive advantage.
- Seek to provide further opportunities to promote the use of radio/wireless systems to enhance Ireland's competitiveness.
- Exploit spectrum to facilitate cross-platform competition in order to maximise the benefit accruing to consumers.
- Where appropriate, continue to liberalise spectrum rights of use, to permit deployment of alternative technologies or services, where harmful interference is not caused.
- Optimise use of the spectrum resource by encouraging the use of spectrum efficient radio systems and the use of the most appropriate frequency band for the application in order to maximise spectrum usage in critical frequency bands.
- Where appropriate, utilise market mechanisms when assigning spectrum where these mechanisms can encourage the efficient use of the spectrum.

24. RAPEX is the EU-wide rapid alert system for all dangerous consumer products. It allows for the rapid exchange of information between Member States and the EC on measures taken to prevent or restrict the marketing or use of products posing a serious risk to the health and safety of consumers. ComReg liaises with the NCA on issues relating radio and electronic products which may pose a risk to consumer welfare

4. Strategy for Managing the Radio Spectrum continued

4.4.3 Spectrum Strategy in Support of Innovation

High Level Goal

To promote innovation in converging platforms and technologies by creating a supportive and predictable regulatory environment which enables industry and other stakeholders to make informed decisions on future investment, roll-out and deployment of new technologies

Provide appropriate spectrum to the market on a timely basis and in a manner that encourages and facilitates industry innovation

Strategies

- Allow potential licensees to determine the amount of spectrum required for their choice of technology and service offering within reasonable, transparent, non-discriminatory and proportionate limits.
- Facilitate new and innovative services and to support and promote innovation, research and development in new radiocommunication techniques, spectrum-based services and applications.
- Promote the innovative Test and Trial licence scheme to position Ireland as a test-bed for wireless system testing and service trials.
- Align spectrum fees and licence duration with investment cycles so that investors can expect a fair return on investment.
- Release available spectrum under 3 GHz for which there is a demand.
- Utilise market mechanisms in assigning available spectrum so that prospective licensees have the opportunity to acquire the amount of spectrum they deem necessary.

4.4.4 Spectrum Strategy in Support of the Organisation

High Level Goal

To be a professional, innovative organisation that is a leading source of expertise in the communications sector

Develop and implement regulatory policies in accordance with international and national standards

Strategies

- Continue to consult regularly and widely on spectrum issues in order to have the benefit of industry and other stakeholders' views when making decisions.
- Continue to work to protect Ireland's national interests when harmonising and co-ordinating spectrum utilisation with other countries, regional and international organisations.
- Continue to work with all stakeholders to ensure the efficient use of spectrum in Ireland.
- Plan and manage the utilisation of the spectrum resource in accordance with both national and international legislation.
- Where appropriate, ensure compliance with international agreements on frequency usage and technical standards as a requirement for spectrum access, recognising that these agreements are necessary for system operation, efficient spectrum management, spectrum utilisation, compatibility, competitiveness and avoidance of interference.
- Continue to represent and promote Irelands position with regard to all radio services in the relevant international fora, at both a regional (European) and Global level, within the EU, ITU and CEPT.

- To influence European legal and regulatory developments in order to ensure that Ireland's best interests are promoted and protected, and that:
 - The correct balance is achieved in the philosophy and practise of spectrum management between different sectors.
 - Sufficient flexibility is achieved to ensure that future spectrum management initiatives are not unnecessarily limited.
 - A wide range of spectrum management tools are made available so that best practise in spectrum management can be achieved.
- Continue to enforce legislation, pursue policies and enhance current practices to ensure that:
 - Unlicensed broadcasters and operators continue to be prosecuted under Wireless Telegraphy legislation to prevent interference to licensees (e.g. Emergency Services, Mobile Network Operators, Business Radio Operators, Point-To-Point Links etc.).
 - Compliance with licence conditions is continuously monitored and licences are revoked if serious breaches are found.
 - Market surveillance and co-operation with other NRAs in relation to R&TTE products continues for the purpose of removing non-compliant products from the market.
 - Market surveillance and co-operation with other NRAs in relation to products which fall within the scope of the EMC Directive continues in order to remove non-compliant products from the market.

These broad strategic goals are reflected in ComReg's positions regarding spectrum for specific services, detailed in Section 5.

5. Strategy for Specific Radio Services

Radio spectrum is available for the provision of a variety of communications services and networks. These include radio transmission networks, public access services – such as mobile telephony and broadband access networks, broadcast networks as well as radio navigation systems, business radio, ships' radio, amateur radio, consumer products and equipment used in industry, medicine and commerce.

In addition, the nature of the spectrum means that certain parts of the spectrum are more suitable for particular purposes than others.

5.1 Wireless Platforms for Electronic Communication Services

In March 2008, the European Commission's Communications Committee (CoCom) expressed a positive opinion on the Draft Commission Recommendation (RSCOM08-16²⁵) on the "non-technical conditions attached to rights of use for radio frequencies under the regulatory framework for electronic communications in the context of the Wireless Access Policy for Electronic Communications (WAPECS)".

WAPECS is a framework for the provision of electronic communications services within a set of frequency bands to be identified and agreed between European Union Member States in which a range of electronic communications networks and electronic communications services may be offered on a technology and service neutral basis, provided that certain technical requirements are met, i.e., to avoid interference, to ensure the effective and efficient use of the spectrum and the authorisation conditions do not distort competition.

The term "WAPECS" has been used to signal a move away from too narrowly specified allocations and applications, for which specific spectrum is designated. Under this definition of WAPECS, it is envisaged that technologies will be stimulated to deliver all electronic communications services within their capabilities, making use of any frequency band and networks. However, this is subject to technical coexistence requirements which need to be tailored to each specific band.

Within the European framework of WAPECS, ComReg's strategy is to:

- Develop a generic licensing framework and the necessary secondary instruments that permit the licensing of WAPECS services, which may include multimedia services, in Ireland. This licensing framework will promote technology and service neutrality and ensure that spectrum assigned is used efficiently and effectively.
- Investigate further the options for use of the band 2300-2400 MHz in the context of related demands on spectrum in other bands. A consultation on this matter is planned for late 2008.

25. http://ec.europa.eu/information_society/policy/radio_spectrum/docs/ref_docs/rsc23_public_docs/rsc08-16%20results%20wapecs%20recommendation.pdf

5.2 Public Mobile Services

Mobile communications is one of the fastest growing sectors in telecommunications with mobile phone penetration rates in Ireland now standing at 121%²⁶. The key drivers of demand for public mobile spectrum are likely to be new and faster data applications, for example the delivery of audiovisual content to mobile phones, high speed access to the Internet or corporate intranets and the provision of ubiquitous mobile broadband across Ireland.

Ireland continues to experience demand for innovative wireless services. In this regard, 900 MHz, 1800 MHz and 2 GHz spectrum is very attractive for the provision of such services because of its propagation characteristics and the ready availability of equipment. ComReg is obliged to ensure the efficient use of the radio spectrum and is therefore investigating all options on how best to accommodate these innovative services. In addition, two of the 900MHz GSM licences expire in 2011 followed by the third 900 MHz GSM licence, and all of the 1800 MHz GSM licences expire in 2015. It is prudent that ComReg consider the available options in order to maintain a supportive and predictable regulatory environment in line with ComReg's high level goals.

There are numerous options available to ComReg regarding the unassigned GSM spectrum, as well as what action to take in light of various licences expiring in the next few years. Therefore ComReg's proposed strategy for the public mobile services over the next two years centres on:

- Conducting a comprehensive public consultation(s) on the 900 MHz and 1800 MHz bands starting in Q308 in order to make an informed decision well before any licences expire. This consultation is also intended to cover the possible release of currently unassigned spectrum in the 900 and 1800 MHz.
- Conducting a public consultation on the use and licencing methodology to be used in the release of the 2010-2025 MHz spectrum band.
- Continuing, among other things, its involvement in European fora in developing appropriate sharing criteria between different possible users of these bands.

- Continuing to monitor and publish the results of the quality of service surveys offered by current GSM and 3G licensees.
- Accommodating requirements for trials of wireless technologies on a non-interference, non-protected basis.

5.2.1 ComReg's position on the 2.6 GHz band

Considerable interest has been expressed with regard to the future use of the band 2500 – 2600 MHz (the 2.6 GHz band) both in stakeholder meetings and in responses received to the consultation on this strategy statement.

In March 2005 the CEPT Electronic Communications Committee developed a non-binding Decision²⁷ to provide a common approach across Europe for designating the frequency band 2500 – 2690 MHz for terrestrial IMT-2000/UMTS systems from January 2008, subject to market demand and national licensing schemes.

In April 2008, the European Commission's Radio Spectrum Committee (RSC) expressed a positive regulatory opinion approving the final draft of the Commission Decision on the harmonisation of the 2500-2690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community²⁸. The EC adopted this decision on 13 June 2008.

ComReg has been exploring a long term strategy, examining the available options and remaining informed on developments across Europe that relate to this band. The primary issue, however, is that there are a number of existing licences operating in this band for the provision of MMDS. The licences have specific rights and obligations and are scheduled to expire in 2012 and 2014. The legislation requires ComReg to review the licences no earlier than April 2010.

Therefore ComReg proposes to conduct a public consultation on the future of the MMDS licences and the use of the frequency band 2500-2690 MHz during 2010.

26. Quarterly Key Data Report – June 2008 – ComReg Doc 08/43.

27. ECC Decision of 18 March 2005 on harmonised utilisation of spectrum for IMT-2000/UMTS systems operating within the band 2500 – 2690 MHz (ECC/DEC/(05)05).

28. http://ec.europa.eu/information_society/policy/radio_spectrum/docs/ref_docs/rsc23_public_docs/rscom08-02.pdf

5. Strategy for Specific Radio Services continued

5.3 Broadcasting Services

Broadcasting is a major user of the radio frequency spectrum. ComReg is responsible for the allocation, assignment and licensing of the associated radio frequencies used by broadcasters. It should be noted that ComReg is not responsible for the regulation of broadcasting content. This responsibility lies with the BCI for the independent television and radio sector and with the Radio Telefís Éireann (RTÉ) Authority for RTÉ programme services. ComReg works closely in close co-operation with both these bodies on the assignment of radio spectrum to ensure the efficient use this key natural resource.

ComReg's strategy for broadcasting over the next two year period is to:

- Facilitate the introduction of Digital Terrestrial Broadcasting (including fixed reception and mobile TV) in UHF Bands IV and V.
- Facilitate the introduction of digital broadcasting technologies in VHF Band III.
- Monitor the development of digital modulation techniques that have the potential to replace the analogue service with high quality broadcast services in the VHF, short wave, medium wave and long wave broadcast bands.
- Ensure present operator compliance and protect authorised services from illegal use of spectrum.
- Seek to licence mobile multimedia services in the UHF band (500 MHz). ComReg recognises there is a demand for a mobile TV service in Ireland and is consulting on the licence conditions which could be applied to mobile TV²⁹.
- As the needs of DTT are addressed, provide clarity on ComReg's digital dividend strategy in preparation for analogue switch-off in Ireland.

5.3.1 ComReg's Position on the Digital Dividend

Analogue terrestrial television is an important platform that reflects the democratic, social and cultural values of Irish society and media pluralism in Ireland. Digital Terrestrial Television (DTT) technology provides a more efficient use of spectrum than the traditional analogue service. Replicating the current analogue TV broadcasting services on an equivalent digital platform requires less spectrum, resulting in a surplus of spectrum used for the provision of terrestrial broadcasting and it is this potential surplus that is known as the 'Digital Dividend'.

Digital dividend spectrum could be utilised for non-broadcasting services increasing competition and giving consumer's additional choice. Digital Dividend spectrum can also be used for new broadcasting services adding further to the democratic, social and cultural values already offered by the current analogue terrestrial television platform.

Across Europe, there has been significant debate about the potential benefits to the broadcasting and wireless communications industry that can be derived from the Digital Dividend. In November 2007, the EC launched a paper³⁰ which concluded that the full benefits of the digital dividend can only be realised with the support and active cooperation of Member States and all stakeholders, and if a common approach is adopted to spectrum planning.

It is clear that, not only in Ireland but throughout Europe, utilising the Digital Dividend is an important issue with significant policy implications both for broadcasting as well as the development of electronic communications. The decision on spectrum use following analogue switch off will involve national policy and ComReg's strategies, including for example the licensing of mobile multimedia services, will need to take this into full regard.

As the roll-out of DTT begins in Ireland later this year the spectrum requirements for digital broadcasting will become clearer once all the requirements laid out in the Broadcasting (Amendment) Act 2007³¹ (and as restated in the Broadcasting Bill 2008³²) have been fulfilled.

29. ComReg Document 08/44 - Consultation Paper - Award of available UHF spectrum in the urban areas of Cork, Dublin, Galway, Limerick and Waterford and related licensing options - published 18 June 08.

30. Reaping the full benefits of the digital dividend in Europe: A common approach to the use of the spectrum released by the digital switchover http://ec.europa.eu/information_society/policy/radio_spectrum/docs/ref_docs/com/com_dd_en.pdf

31. Broadcasting (Amendment) Act of 2007, number 15 of 2007.

32. Broadcasting Bill, 2008 [Number 29a of 2008]

In order to advance the debate on this important issue in Ireland, ComReg has set aside its National Conference³³ in October of this year to focus on the Digital Dividend. As a consequence of that conference, ComReg will prepare a public consultation document later this year on its proposed strategy for Digital Dividend.

5.4 The Terrestrial Fixed Services

The bands above 1 GHz, often referred to as the microwave bands, are used predominantly for fixed point-to-point links or point-to-multipoint links ('fixed links'). These fixed links are used mainly by telecommunications operators, mobile phone operators, broadcasters, utilities, and the emergency services to provide transmission networks which are flexible, cost effective and to provide redundancy and back-up for other networks. They are used extensively in fixed telecommunications networks both to carry trunk traffic and to provide broadband access networks and therefore play a vital role in the development of a competitive telecommunications industry in Ireland.

Recently ComReg completed a licence competition³⁴ for the 26 GHz band which enabled the market to decide the amount of spectrum that would be managed by licensees and the amount of spectrum that would continue to be licensed by ComReg under its individual licencing regime. The competition also established the split between point-to-point and point-to-multipoint use of the band. ComReg will consider this methodology when opening up new fixed service bands.

While in the long term, fibre infrastructure is the most appropriate medium for emerging broadband services, it is recognised that radio links facilitate the early development of infrastructure and competition in the provision of electronic communications services, especially in rural areas. In this regard, ComReg's short to medium term strategy is to encourage the use of fixed links for infrastructure and competition development, for the maximum benefit of all licensees and in particular new market entrants. As networks develop and congestion in the fixed links bands grows, the strategy will be to encourage established fixed link licensees to migrate to fibre-based infrastructure.

ComReg's strategy for terrestrial fixed services includes:

- Closing the 450 MHz fixed link band (450 – 470 MHz) to new applications and over the next three years to migrate all remaining links out this band.
- Closing the lower 20 MHz of the 1.3 GHz band (1350 – 1370 MHz / 1492 – 1512 MHz) to new applications. Utilise the upper 5 MHz, i.e., 1370 – 1375 MHz / 1512 – 1517 MHz) for new applications and over the next three years migrate all current links into the upper part of the band.
- Closing the upper 15 MHz of the 1.4 GHz fixed link band (1385 – 1400 MHz / 1437 – 1452 MHz) and utilise the lower 10 MHz (1375 – 1385 MHz / 1427 – 1437 MHz) of the band for new applications³⁵.
- Maintaining the current status of the 2 GHz band (2025 - 2110 MHz / 2200 – 2290 MHz) as a fixed link band and requiring licensees to upgrade their equipment to more efficient technologies. Such an upgrade would lead to greater spectrum efficiency and could potentially release spectrum for more point-to-point fixed links or other use (e.g. mobile, fixed).
- Encouraging operators to use the latest technology and higher order modulation schemes in order to ensure efficient use of the spectrum.
- Introducing administrative incentive pricing, based on bandwidth used and location of terminals, to encourage the use of more bandwidth efficient technologies and the use of alternative platforms in congested bands/areas³⁶.
- Considering the timing and methodology (e.g. individual licensing, block licensing, etc.) to be used in opening new fixed link bands (28 GHz and 31/32 GHz). As part of this work put in place a licensing regime to cater for wireless CCTV applications in these bands.

33. 'How Ireland can best benefit from its Digital Dividend' on Wednesday, October 1, 2008 in The Ballroom, The Conrad Hotel, Dublin.

34. See ComReg media release PR060608 and the 26 GHz competition website on www.comreg.ie

35. No relocation of any existing users is required.

36. This is the implementation of the review of fees undertaken in December 2005 – ComReg Doc 05/89.

5. Strategy for Specific Radio Services continued

5.5 Wireless Broadband Services

Wireless Broadband Services (WBS) refers to the delivery of broadband access services to residential or business users by terrestrial wireless networks (also known as Broadband Wireless Access). WBS provides an alternative to wired solutions such as digital subscriber line (DSL) or cable, providing competition to incumbent operators and extending broadband access in 'the last mile' to areas where wired solutions are technically or economically unviable. In comparison with other European countries, Ireland is advanced in the use of wireless technologies for the delivery of broadband services.

Considering the current state of the market for broadband services, the optimum approach to licensing WBS appears therefore to be to match the availability of the spectrum resource to realistic market scenarios and ComReg will continue to keep this principle in mind when releasing spectrum for WBS services.

In Ireland the DCENR is currently running a technology neutral scheme, the National Broadband Scheme (NBS) to reach the economically unviable regions of Ireland. In support of this initiative ComReg has set aside 10 MHz of spectrum in the 3.5 GHz band, if required by the winner of the tender process, for use in the NBS identified areas.

In May 2008 the EC adopted a Decision³⁷ harmonising the conditions of use of the 3.4 – 3.8 GHz band for fixed, nomadic and mobile applications. ComReg is working to implement the articles of this Decision which also mandates mobility in this spectrum band.

ComReg's strategy for WBS over the next two years is:

- Continuing the work of the FWALA Operators Forum, the objectives of which include promoting WBS as a viable and reliable alternative platform for the provision of electronic communications services.
- Identifying appropriate spectrum allocations, both licensed and licence-exempt, for WBS which are supported, or likely to be supported, by ready availability of choice of equipment.
- Implementing the EC Decision on the 3.4 – 3.8 GHz band as soon as practicable noting that more than 120 licences have been issued in this band under the FWALA licensing scheme.
- Releasing additional spectrum in the 3.4 – 3.8 GHz band (≈ 100 MHz) to facilitate additional Wireless Broadband Services.
- Releasing additional spectrum in the 10 GHz band to facilitate additional Wireless Broadband Services.

³⁷. European Commission Decision of 21.5.2008 on the harmonisation of the 3400-3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community

5.6 Licence Exempt Services

Among the most prevalent radio systems in Ireland are Short Range Devices (SRDs). SRDs are generally exempt from licensing and operate in frequency bands shared with other users and services on a non interference, non-protected basis. Effectively, due to the very low power levels used by SRDs, this means that they should not cause interference to other spectrum users, nor can they claim protection from interference from other spectrum users.

In Ireland, SRDs are licence exempt subject to meeting certain technical criteria, e.g., maximum power levels and reference standards. The technical criteria for the operation of SRDs in Ireland are laid down in ComReg document 02/71. In addition, all SRDs placed on the market are required to comply with the R&TTE Directive.

ComReg's strategy for short-range devices during the period of this strategy includes:

- Facilitating new SRD applications by making spectrum available wherever possible for such applications, subject to demand and technical feasibility – bearing in mind that additional spectrum should only be made available to SRDs on the basis of a clear and demonstrable need. Any analysis of the case for new spectrum should include a valid reason why existing SRD spectrum is unsuitable and must fully take into account the impact on radio services.
- Implementing the EC Decision³⁸, which allows the use of the radio spectrum for equipment using ultra-wideband technology (UWB), by adding UWB technology that falls within the technical parameters given in the EC Decision to the list of licence-exempt devices in Ireland (ComReg Doc. 02/71R as revised).
- Considering the most appropriate method to authorise the use of Building Material Analysis (BMA) devices using UWB technology³⁹, including licence exemption.
- Ensuring that only the minimum regulations are specified in ComReg 02/71 (as revised) and, where appropriate, the application-specific constraints to spectrum use are removed.
- Ensuring that the principles of application and technology neutrality are pursued wherever possible in both changes to the existing regulatory environment and in the assessment of requests for new spectrum.

- Contribute to the debate, within CEPT and the EC on the possibility of developing limits below which a new class of generic Ultra Low Power (ULP) SRDs need not be subject to the usual regulatory arrangements (such as channelisation, duty cycles, etc.), and that would ensure the protection of all radio services.

5.7 Maritime Services

The maritime sector is a significant spectrum user, comprising a large leisure component, an extensive fishing industry, a competitive commercial sector and a wide-ranging naval presence. Due to the global nature of maritime services, the management of the radio spectrum is largely governed by national and international regulations (such as those relating to safety of life at sea).

ComReg's strategy for the duration of this plan for Maritime Services includes:

- Continuing to provide support to Ireland at international fora to ensure adequate spectrum is available for maritime services.
- Continuing to prioritise and provide protection from interference to maritime safety of life services.
- Establishing a framework for the licensing of land based Automatic Identification Systems (AIS).
- Continuing to work with the MRAU to promote the use of spectrum efficient technologies in the maritime bands, thereby maximising the spectrum available for growth and new applications.
- ComReg will finalise the regulatory framework to licence land based radionavigation and radiolocation stations used by the maritime services. There will be a once-off licensing fee for these services, subject to DCENR agreement, for new stations, to cover co-ordination and notification costs. Existing stations will be licensed without cost.

38. European Commission Decision of 21 February 2007 on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (2007/131/EC)

39. ECC Decision of 30 March 2007 on Building Material Analysis (BMA) devices using UWB technology (ECC/DEC/07/01) defines the technical parameters of use.

5. Strategy for Specific Radio Services continued

5.8 Aeronautical Services

The safety and efficiency of air transport is dependent on navigation and communication services that use radiofrequencies. Since the bulk of air travel is international in nature, most of the radio spectrum that is used by the aeronautical sector is planned internationally.

ComReg's strategy for the duration of this plan for aeronautical services is:

- Continue to provide support to Ireland in relevant international fora to ensure adequate spectrum is available for aeronautical services;
- Continue to prioritise and provide protection from interference to aeronautical safety of life services;
- Continue to work with the Irish Aviation Authority (IAA) to promote the use of spectrum efficient technologies in the aeronautical bands, thereby maximising the spectrum available for growth and new applications;
- Finalize the regulatory framework to licence land based radionavigation and radiolocation stations used by the aeronautical services. There will be a once-off licensing fee for these services, subject to DCENR agreement, for new stations, to cover co-ordination and notification costs. Existing stations will be licensed without cost.

5.9 Satellite Services

Satellite radiocommunication networks provide a wide range of applications from mobile and fixed telecommunications, Direct to Home (DTH) multichannel television, broadband services, satellite news gathering (SNG), to meteorological, space research and Earth exploration service applications. Additionally, satellites play a crucial role in aeronautical and maritime safety by providing services such as navigation, radar and the Global Positioning System (GPS).

A recent development, specifically in satellite provided mobile and multimedia communications services is the concept of a Complementary Ground Component (CGC). The CGC of a satellite network comprises ground-based stations deployed at fixed locations in order to improve the availability of the mobile satellite service in zones where communications with one or several space stations cannot be ensured with the required quality of service. These CGC networks use the same direction of transmission and the same portions of frequency bands as the associated satellite components and should operate within the same spectrum requirement as its associated mobile satellite system.

ComReg's strategy for Satellite Services for the duration of this plan includes:

- Responding to requests for frequency coordination involving satellite services in such a manner as to ensure equitable access to the radio spectrum for both satellite and terrestrial services which share the same or adjacent frequency bands on the basis of applicable national and international regulations;
- Contributing to the current EC initiative to authorise a pan-European Mobile-Satellite Service (MSS) in the 2 GHz bands and the subsequent demand for CGC in support of that satellite network;
- Reacting positively to proposals for deployment of satellite-based services and CGC networks in Ireland.
- Developing a licencing regime for MSS in the 2 GHz band as required in EC Decision 2007/98/EC⁴⁰.

40. EC Decision 2007/98/EC of 14 February 2007 on the harmonised use of radio spectrum in the 2 GHz frequency bands for the implementation of systems providing mobile satellite services.

5.10 Business Radio and Public Safety Services

Despite the continued rapid growth of cellular telephony, business radio is still a popular communication system for applications where most traffic is between a control point and one or more mobile terminals, or where groups of mobile terminals need to communicate on a "one to all" basis. The main uses of business radio are for public safety and security (e.g., the Garda Síochána, fire and ambulance emergency services), public utilities industrial and commercial users (taxis, couriers, warehouses etc.) as well as various voluntary organisations, all of whom need reliable means of communicating with personnel and especially those on the move.

ComReg's strategy for business radio and public safety services over the next two years includes:

- Continuing to support the requirements of the business radio industry and users to ensure that spectrum is available to accommodate new business radio technologies and that existing licences for analogue systems can be upgraded to digital where required.
- Encouraging the development and use of new spectrally efficient technologies.
- Reviewing the business radio frequency bands with a view to ensuring that there is adequate spectrum for the introduction of new and emerging digital technologies.
- Finalising the regulatory framework for all paging services by replacing the issue of permits with licences.
- Continuing to monitor Business Radio installations to ensure compliance with licence conditions.
- Implementing a fee structure that takes into account key criteria such as bandwidth used, exclusive use, geographic location and range of coverage⁴¹.
- In line with a EC Decision⁴² ComReg will license the high power part of the 169.6 – 169.8125 MHz band for the use of high power tracing and asset tracking systems and high power paging systems under its business radio licence scheme.
- In 2009-2010, reviewing the effectiveness of the Third Party Business Radio (TPBR) scheme.

- Facilitating the deployment of the managed digital radio service for the emergency services and non-commercial public bodies⁴³.
- Consult on how to use the significant quantities of VHF and UHF spectrum that will be released by various state agencies over the next two years as the managed digital radio service is rolled out.

5.11 Radio Experimenters (Amateur Service)

The Amateur Service⁴⁴ is specifically recognised by the ITU as a service for the purpose of self-training and technical investigations and as such has specific spectrum allocated to it within the International Table of Frequency Allocations. Radio Amateurs in Ireland are referred to as Experimenters and are licensed under the Wireless Telegraphy (Experimenter's Licence) Regulations 2002, S.I. 450 of 2002.

ComReg's strategy for Radio Experimenters over the next two years is to:

- Implement a once-off, life-time fee structure for experimenters;
- Update the current guideline documents to include general access to the 70 MHz band, access to spot frequencies in the 5 MHz band and upgrading of the amateur allocation in the 7100 – 7200 kHz band to primary status.
- Facilitate the short term authorisation of visiting experimenters to Ireland;
- Modify the format of repeater station callsigns in Ireland in order to differentiate these from personal callsigns;
- Consider the allocation of spectrum around 500 kHz on the basis of a common European position.

41. This is the implementation of the review of fees undertaken in December 2005 – ComReg doc 05/89.

42. Commission Decision of 20 December 2005 on the harmonisation of the 169.4 – 169.8125 MHz frequency band in the community [2005/928/EC].

43. Press release by the Department of Justice, equality and law reform "National Digital Radio Service for An Garda Síochána", 26 March 2007.

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

5. Strategy for Specific Radio Services continued

5.12 Science Services

The radio spectrum is used for a wide range of applications that operate under the generic description of 'science services'. These include radio astronomy, meteorological satellite and meteorological aids, earth exploration-satellite services, space research and space operation services. Scientific usage of spectrum has significant social and economic benefits.

ComReg's strategy covering the Science Services includes:

- Liasing with Met Éireann⁴⁵ and other scientific organisations to ensure that current and future spectrum requirements of the Science Services are fully understood and, wherever possible, incorporated into national plans for future spectrum planning conferences.
- Continuing to offer a high degree of protection to meteorological services, particularly in view of their use in the safeguarding of human life and property.
- Continuing to offer a high degree of protection to Earth-exploration services in view of the potential impact of interference on passive and active sensors which could severely disrupt scientific research programmes, including research into climate change.
- In line with the RSPG Opinion⁴⁶ to protect the science service by taking into account the provisions of footnote number 5.340⁴⁷ of the ITU Radio regulations.
- Introducing (as for aeronautical and maritime radar) a licensing regime for meteorological radars, subject to DCENR agreement. A one-off licence fee of around €500 for new stations will apply, to cover co-ordination and notification costs. Existing meteorological radars will be licensed without cost.

5.13 Defence Forces Use of Spectrum

Defence forces have actively utilised radiocommunications from the earliest days and their use of radio spectrum is considered critical to national security. There are no specific service allocations for defence applications in the International Radio Regulations as defence communications are recognised as the prerogative of each sovereign nation.

In accordance with the Wireless Telegraphy Act 1926, apparatus for wireless telegraphy kept by or in the possession of the Minister for Defence, for the purpose of the Defence Forces, does not require a licence. ComReg maintains an awareness of international developments and will continue to liaise with the Defence Forces as required to solve issues of mutual concern.

45. The main user of radiofrequency spectrum for meteorology in Ireland is by Met Éireann, the Irish National Meteorological Service, which is the leading provider of weather information and related services for Ireland with a mission to monitor, analyse and predict Ireland's weather and climate, and to provide a range of high quality meteorological and related information to customers.

46. Radio Spectrum Policy Group (RSPG) Report and Opinion on "a Coordinated EU Spectrum Approach for Scientific Use of Radio Spectrum" - 25 October 2006.

47. ITU RR Footnote 5.340 All emissions are prohibited in the following bands: 1 400-1 427 MHz, 2 690 -2 700 MHz, except those provided for by No. 5.422, 10.68-10.7 GHz - except those provided for by No. 5.483, 15.35-15.4 GHz - except those provided for by No. 5.511, 23.6-24 GHz, 31.3-31.5 GHz, 31.5-31.8 GHz - in Region 2, 48.94-49.04 GHz - from airborne stations 50.2-50.4 GHz, 52.6-54.25 GHz, 86-92 GHz, 100-102 GHz, 109.5-111.8 GHz, 114.25-116 GHz, 148.5-151.5 GHz, 164-167 GHz, 182-185 GHz, 190-191.8 GHz, 200-209 GHz, 226-231.5 GHz, 250-252 GHz.

Annex A:

Summary of the Legal and Regulatory Framework for Spectrum Management in Ireland

The National Framework

During the liberalisation of the telecommunications sector across Europe in the 1990's many countries established an independent regulator to deal impartially with the sector. In Ireland, ComReg is the National Regulatory Authority (NRA) responsible for the regulation of the electronic communications sector (telecommunications, radiocommunications and broadcasting transmission) and the postal sector.

One of the functions of ComReg is to manage the radio frequency spectrum. In carrying out this role, ComReg must:

- take into account any policy directions issued by the Minister for Communications, Marine and Natural Resources;
- ensure that measures taken are proportionate in meeting its objective to ensure the efficient management and use of the radio spectrum; and
- have regard to international developments with regard to the radio frequency spectrum.

The role of the Minister for Communications, Energy and Natural Resources in regard to spectrum management is to develop primary and secondary legislation and to develop and publish national policy.

The main Acts governing the radio sector are the Wireless Telegraphy of 1926, 1956, 1972 and the Broadcasting and Wireless Telegraphy⁴⁸ Act, 1988 (together "WT Acts"). The WT Acts provide for the licensing of radio systems in Ireland. Under these Acts, the possession and use of apparatus for wireless telegraphy requires authorisation – either by a licence or licence exemption.

The primary legislation applicable to the broadcasting sector comprise the Broadcasting Authority Act 1960 as amended, the Broadcasting and Wireless Telegraphy Act 1988, the Broadcasting Act 1990, the Radio and Television Act 1988, the Broadcasting Act 2001, and the Broadcasting (Amendment) Act 2007.

RTÉ is the national broadcaster in Ireland and is licensed under the 1960 Broadcasting Authority Act. The Broadcasting Commission of Ireland (BCI), which manages the independent radio and television sector, is licensed under the Radio and Television Act, 1988 and is responsible for issuing sound and television broadcasting contracts to the independent sector.

It should be noted that ComReg is not responsible for the regulation of broadcasting content. This responsibility lies with the BCI for the independent television and radio sector and with the Radio Telefís Éireann (RTÉ) Authority for RTÉ programme services.

During the life of this document, it is expected that a new body, the Broadcasting Authority of Ireland, will perform the functions of the Broadcasting Commission of Ireland and the Broadcasting Complaints Commission. It will also undertake functions regarding the oversight of public funding for public service broadcasting, and liaise and consult with ComReg in the preparation and allocation of frequency ranges identified for sound and television broadcasting in Ireland.

In July 2003, an EU regulatory framework for electronic communications came into force. This had a significant impact on the manner in which the communications sector is regulated throughout Europe. The framework is comprised of 5 Directives (Framework, Authorisation, Access, Universal Service and Data Protection) and one Decision (Spectrum Decision) and it aims to promote competition, the interests of the citizen (universal service, consumer protection, privacy, dispute resolution) and the single European market. This framework does not include broadcast content regulation.

48. "Apparatus for wireless telegraphy" is defined in the WT Acts as "apparatus capable of emitting and receiving, or emitting only or receiving only, over paths which are not provided by any material substance constructed or arranged for that purpose, electric, magnetic or electro-magnetic energy, of a frequency not exceeding 3 million megahertz, whether or not such energy serves the conveying [whether they are actually received or not] of communications, sounds, signs, visual images or signals, or the actuation or control of machinery or apparatus, and includes any part of such apparatus, or any article capable of being used as part of such apparatus, and also includes any other apparatus which is associated with, or electrically coupled to, apparatus capable of so emitting such energy."

Annex A: continued

Summary of the Legal and Regulatory Framework for Spectrum Management in Ireland

The Regional Framework

The European Union (EU) comprising 27 Member States operates under a series of international treaties. In recent years, the role of spectrum management has increased to a great extent. As an obvious sign of this trend, the EU recently prioritized radio spectrum policy. One of these priorities is the completion of a Single European Information Space. In technical terms, this represents the digital convergence of communication networks, media, content, services and devices. In order to ensure faster broadband services one of the main challenges posed by digital convergence is speed. Thus, offering affordable and secure broadband communications is declared as one of the objectives.

In order to achieve the Single European Information Space, the EC has announced the revision of the regulatory framework for electronic communications, including the development of an effective frequency management strategy. The objective of the strategy is to identify bottlenecks delaying the introduction of faster, more innovative and competitive broadband services. It essentially aims to introduce a market-based model that gives greater freedom to market players as to the method of frequency use and makes obtaining frequency rights easier by allowing trading with such rights. An important part of the frequency management reform was the introduction of a new regulatory package of procedures.

The European Conference of Postal and Telecommunications Administrations (CEPT) was established in 1959 and consists of a body of policy-makers and regulators currently encompassing 48 European countries covering almost the entire geographic area of Europe (see: www.cept.org).

The CEPT, which deals exclusively with sovereign regulatory matters, has established two committees one on postal matters (CERP) and another dealing with radiocommunications and telecommunications issues: the ECC (Electronic Communications Committee). The committees handle harmonisation activities within their respective fields of responsibility, and adopt recommendations and decisions.

ComReg is actively involved in the most relevant CEPT working groups, project teams and the ECC plenary sessions in order to promote and protect Ireland's interests.

The Global Framework

Ireland operates within a global economy. International markets and competition must therefore be taken into account in the development and introduction of new services. Spectrum allocation also has to take the international dimension into account. To maintain an effective and responsive regulatory structure there is an ongoing need for participation in appropriate international fora, to track and influence developments in international regulation, harmonisation of standards and new market opportunities, and to monitor developments in technologies and applications.

International co-operation in the field of telecommunications is handled through a single organisation known as the International Telecommunication Union (ITU) that updates and amends the International Radio Regulations.

The ITU Radio Regulations contain technical and procedural provisions related to each of the various radio services and serve as the primary international agreement covering rules and procedures for operating radio equipment, resolving and preventing interference, and contain the international frequency allocation table. While each nation remains sovereign in their use of the radio spectrum the work of the ITU forms the global framework within which regional and national planning is developed.

Annex B:

List of respondents to consultation

The twenty four respondents to the consultation were, in alphabetical order:

- 3 Ireland
- ALTO
- AREN (Amateur Radio Emergency Network)
- BT
- Michael Higgins EI0CL
- Craig Wireless Systems
- eircom
- ESB Telecoms
- Google
- HEAnet
- Intel
- Irish Broadband
- IRTS (Irish Radio Transmitter Society)
- Meteor
- O2
- Qualcomm
- SES
- Solaris Mobile Ltd
- SEARG (South Eastern Amateur Radio Group)
- Swiftcall
- UPC
- Vodafone
- WiMAX Forum
- WorldSpace

All non-confidential submissions will be made available on ComReg's website.

Annex C:

Calculating the Contribution of Radio Spectrum

The contribution to GDP of a given company making use of radio spectrum was determined by taking the profits generated by its operations ('operating profit') and adding it to company staff payments. Payments to staff provide an indirect contribution to the economy as a result of wages spent.

Depreciation, which denotes the notional loss of corporate assets over time, is subtracted from capital expenditure, which constitutes an addition to the assets of the corporate entity. This provides a more accurate measure of actual cash flows within the economy. The figure for capital expenditure (Capex) is taken for fixed tangible assets only and excludes disposals (assets that are sold or written off by the company).

This can also be expressed in the following way:

GDP contribution = Operating profit + Staff payments + [Depreciation – Capex]

The estimate of GDP contribution is qualified in two important respects. First, the estimate excludes small companies to which the Companies (Amendment) Act 1986 applies⁴⁹. This is because such companies are exempt from filing a full set of financial accounts. As a result, some data needed to perform the GDP contribution estimate cannot be readily obtained in accordance with the above methodology. While the individual turnover amounts for small companies are relatively low, on aggregate the contribution of such companies may actually be quite large but unaccounted for.

The second qualification relates to the types of companies making use of radio. Since users (and uses) of radio spectrum are not homogenous, spectrum was categorized as either fundamental or tangential to various different types of corporate operations.

The provision of mobile services for example can only be undertaken via the use of radio frequencies. This is also true for most broadcasting services provided in Ireland. Radio spectrum can also be considered 'fundamental' to the aviation sector, since the safe operation and volume of air traffic could only be accomplished through the use of radio. Other sectors, such as the medical device industry, make use of radio though only in a tangential way. Clearly not all medical devices produced are wireless medical devices, but it is difficult to assess the nature and extent of radio use in this industry as the equipment operates mainly in the 2.4 GHz unlicensed band.

This leads to the following two estimates for the GDP contribution arising out of the use of radio spectrum in Ireland:

- The first is a conservative estimate based on services to which radio spectrum can fairly be regarded as fundamental. In real terms we estimate that this amount to €2.4 bn. or 1.4% of GDP.
- The second more broad-based estimate which consists of those companies where use of spectrum is tangential to their operations amounts to €2.8 bn. or 1.67% GDP.

The approach taken to determine the contribution of radio spectrum to GDP was to include the direct revenue contribution of the relevant operators in each sector in conjunction with estimates of the forward and backward linkages in the economy. These were based on the value chains for spectrum using sectors. For example, for mobile services this approach included revenue generated from mobile retailing and software, security and other suppliers to the mobile sector. For broadcasting services it included revenue generated through forward links to the advertising industry. The wider impacts on the economy as a whole were estimated using a general economic multiplier of 1.1 to arrive at the final figures in Table 1⁵⁰. The same multiplier of 1.1 was used in determining employment impacts as shown in table 2.

49. ss 11, 12 Companies (Amendment) Act 1986. 'Small companies' have a turnover of less than €7.3m and fewer than 50 employees.

50. See p. 11 above. In economic theory, multipliers are premised on the notion that an initial spending rise can lead to even greater increase in national income as a result of indirect effects associated with the expenditure. In other words, an initial change in aggregate demand can cause a further change in aggregate output for the economy. The general economic multiplier used in this statement is reported in "The Macro-economy of Ireland," by Leddin and .

Glossary

Term	Definition
3G	Third Generation
BCI	Broadcasting Commission of Ireland
CEPT	Conference of European Telecommunications and Postal Administrations
DAB	Digital Audio Broadcasting
DCENR	Department of Communications, Energy and Natural Resources
DRM	Digital Radio Mondiale
DSL	Digital Subscriber Line
DTT	Digital Terrestrial Television
DVB	Digital Video Broadcasting Standard
DVB-H	Handheld DVB standard, intended for delivery of audiovisual content to mobile terminals
EC	European Commission
ECC	European Communications Committee
ECS	Electronic Communication Service
EMC	Electromagnetic Compatibility
ERC	European Radiocommunications Committee (forerunner to ECC)
ETSI	European Telecommunications Standards Institute
FWA	Fixed Wireless Access
FWALA	Fixed Wireless Access, Local Area
FWPMA	Fixed Wireless Point to Multipoint Access
GDP	Gross Domestic Product
GMDSS	Global Maritime Distress and Safety System
GPRS	General Packet Data Service: Packet data transmission standard for GSM mobile phone networks
GPS	Global Positioning System
GSM	Global System for Mobile Communications: European 2nd generation mobile phone technology now in use worldwide
GSM-R	GSM for railways, variant of GSM mobile phone standard that provides communication and signalling functionality for railway use
IAA	Irish Aviation Authority
ICAO	International Civil Aviation Organisation
ICNIRP	International Committee on Non-Ionising Radiation Protection
IEEE	Institution of Electrical and Electronics Engineers (US Standards Body)
IMT	International Mobile Telecommunications.

Glossary continued

ITU	International Telecommunication Union
Mbit/s	Megabits per second
Microwave	Generic terms for frequencies in the range 3 GHz to 30 GHz
MMDS	Multipoint Microwave Distribution System (for multi-channel TV)
MRAU	Maritime Radio Affairs Unit (Part of the Department of Transport)
MSS	Mobile Satellite Service
NDB	Non-directional Beacon
NIR	Non-Ionising Radiation
NRA	National Regulatory Authority
PAMR	Public Access Mobile Radio, business radio service that provides services to third party subscribers
R&TTE	Radio and Telecommunications Terminals
Radar	Radio determination system based on the comparison of reference signals reflected, or transmitted from the position to be determined. This encompasses meteorological radars and radionavigation systems.
Radio-determination	Determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves.
RTTT	Road Traffic Telemetry and Telematics
SI	Statutory Instrument
SNG	Satellite news gathering
SRD	Short Range Device
TCAM	EU Telecommunications Conformity Assessment and Market Surveillance Committee and Market Surveillance Committee
TDAB	Terrestrial Digital Audio Broadcasting
TETRA	Terrestrial Trunked Radio, European digital trunked mobile radio standard
UHF	Ultra High Frequency (300 MHz to 3 GHz)
UMTS	Universal Mobile Telecommunications System: European 3rd generation standard, part of IMT-2000 family of standards
UWB	Ultra Wideband
VHF	Very High Frequency (30 MHz to 300 MHz)
Wi-Fi	Commercial name for WLAN devices operating in the 2.4 GHz and 5 GHz bands, based on the IEEE 802.11 series of standards
WiMAX	Family of standards under development for broadband wireless, also referred to as IEEE 802.16
WLAN	Wireless Local Area Network
WRC	World Radiocommunication Conference