

SPECTRUM MANAGEMENT

STRATEGY STATEMENT 2005 -2007



Commission for
Communications Regulation

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2005-2007

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Commission for
Communications Regulation



FOREWORD

SPECTRUM MANAGEMENT STRATEGY STATEMENT 2005 - 2007

1

Foreword

The Commission for Communications Regulation (ComReg) is responsible for the efficient management and use of the radio spectrum, one of Ireland's key natural resources. In May 2002 the ODTR (now ComReg) published its first Radio Spectrum Strategy document¹. ComReg aims to update its spectrum strategy every two to three years and to this end published a draft strategy document for consultation in January 2005². This final version of the 2005 spectrum strategy takes account of comments received in response to that consultation, a summary of which can be found in ComReg document 05/36.

The radio frequency spectrum is used to support a large number of electronic communications services and applications. Access to radio frequencies is an essential requirement for telecommunications, particularly for aviation, shipping, defence services, public safety, broadcasting and the many private businesses that rely on mobile radio. One of the most significant users of both mobile and fixed link radio spectrum are mobile phone services which continue to expand, currently delivering services to over 3.5 million subscribers in Ireland.

Wireless communications are also increasingly being used to provide broadband access to the Internet, e-mail and other on-line services. As part of an initiative to promote more competition in the delivery of broadband, ComReg recently awarded local wireless broadband licenses which, it is hoped, will make a major contribution to achieving affordable broadband access, especially in rural areas.

ComReg was also the first regulator in Europe to introduce licence exempt wireless broadband access in the 5.8 GHz band (5725-5875 MHz) and in May 2005 we launched a new licensing regime for radio service and technology trials which will bring Ireland to the forefront as an ideal location for research and development. This will allow new service concepts to be tested in a realistic environment at an early stage of development, ensuring that subsequent commercial offerings are properly tailored to meet the needs of users.

ComReg reviews its spectrum strategy at regular intervals to reflect changes in markets, technologies and legislation. Of particular relevance currently is greater emphasis from a regulatory perspective on technology neutrality, obligations to promote sustainable competition and the development of the internal European market. ComReg's strategy needs to reflect international and regional developments including, for example, changes arising from the recent World Radiocommunication Conference (WRC-03).

We are cognisant of moves by Regulators across Europe and beyond towards a more liberalised market-based approach to spectrum management. In line with these developments, we have consulted on and will offer four licences for wideband digital mobile services in 2005 on a first-come-first-served basis, leading to an auction if demand exceeds supply.

Our approach to spectrum management is to regulate only where required and to intervene only where necessary to promote competition or avoid harmful interference. Key elements of this approach include enforcing compliance with licence conditions and careful frequency planning to avoid harmful interference between radio services.

Isolde Goggin
Chairperson.

¹ Document ODTR 02/43, "Strategic Management of the Radio Spectrum in Ireland"

² ComReg Document 05/01 "Preparing the radio spectrum management strategy for 2005 – 2007."

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EXECUTIVE SUMMARY

SPECTRUM MANAGEMENT STRATEGY STATEMENT 2005 - 2007

Commission for
Communications Regulation

2 Executive Summary

This document sets out ComReg's strategy for managing the use of the radio spectrum in Ireland over the next two to five years. The radio frequency spectrum is a vital and finite natural resource which provides the means to convey audio, video or other information content over distances from a few metres to thousands of kilometres. Radio spectrum is essential for the provision of mobile communications and to provide wireless reception of broadcast services. It is also fundamental to the safe operation of air and maritime transport, is used widely by the defence forces and emergency services and supports important scientific applications such as meteorology and radio astronomy. ComReg's spectrum strategy is intended to ensure that Ireland can leverage the maximum benefits economically, strategically and in a wider social context, from use of the radio spectrum.

As part of its strategy development, ComReg commissioned research to determine the contribution made by the use of radio spectrum to the Irish economy. This research estimated that the contribution for 2003 is almost €2 Billion, equivalent to 1.4% of total GDP. The number of employees whose jobs are dependent on use of the radio spectrum was, conservatively, estimated to be over 24,000.

ComReg's broad spectrum strategy focuses on four main **Objectives**, namely:

- (i) Facilitating access to radio spectrum, particularly for innovative technologies and services;
- (ii) Maximising the economic and social benefits arising from the use of radio spectrum;
- (iii) Promoting the efficient use of scarce radio spectrum resources; and
- (iv) Ensuring compliance with national and international requirements and the avoidance of harmful interference.

For each of these objectives a number of specific goals have been set and specific actions identified for the various categories of spectrum use. The following table highlights for each radiocommunication **service** the **key issues** identified and the **strategy** in each case for dealing with these issues in relation to one or more of the four **objectives** shown above.

Service	Key Issues	Strategy	Objectives	Section
All	Promotion and protection of use of the radio spectrum in Ireland	Continue to represent and promote Ireland's position both at home and abroad, with regard to all radio services in bilateral discussions with neighbouring countries and at the relevant international fora within the European Union (EU), International Telecommunications Union (ITU) and European Conference for Postal and Telecommunications Administrations (CEPT).	i, ii, iii, iv	5.1.4.
Public Mobile	Future expansion spectrum for 3G mobile services	Consider future of 2010 – 2025 MHz band for other services.	i, ii	5.3.1.1.
		Consultation with industry to develop a coherent strategy to facilitate the development of Third Generation (3G) services in the 2.6 GHz band subject to market demand whilst accommodating any ongoing requirement by Multipoint Microwave Distribution System (MMDS) operators and their customers.	i, ii, iv	
	Demand for innovative wireless services (e.g. wideband Public Access Mobile Radio)	Consider possible future uses for remaining Global System for Mobile Communication (GSM) and International Mobile Telecommunications 2000 (IMT-2000) spectrum. Consider other frequency bands which may be used for these services.	i, ii, iii	5.3.1.2.
		Designation of 900 / 1800 MHz GSM bands for 3G mobile.	Participate in European work on this initiative and consult with all interested parties on implications.	i, ii, iii
Broadcasting	Introduction of digital broadcasting in Ireland	Monitor the development of digital modulation techniques that have the potential to replace the analogue radio service with high quality broadcast services in the short wave, medium wave and long wave broadcast bands.	i, ii, iii	5.4.1.
		Continue planning and co-ordination for rollout of Digital Terrestrial Television (DTT).	i, ii, iii	5.4.2.

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Executive Summary Continued

Service	Key Issues	Strategy	Objectives	Section
Broadcasting	Television and Sound Broadcasting	Review spectrum options for Digital Video Broadcasting (DVB) and/or Digital Audio Broadcasting (DAB) based delivery of content to mobile platforms and handheld/portable devices.	i, ii, iii	5.4.2.
		Ensure operator compliance and protect authorised services from illegal spectrum use.	iii, iv	
		Prepare for RRC-06: ComReg is working with the DCMNR, the Broadcasting Commission of Ireland (BCI) and Radio Telefís Éireann (RTÉ) in preparation for the forthcoming 2006 Regional Radiocommunication Conference to re-plan the broadcast bands III, IV and V, currently covered by the Stockholm Agreement. The frequency plan(s) to be agreed at the RRC will form the basis for Very High Frequency/Ultra High Frequency (VHF/UHF) broadcasting in Europe for possibly the next 20 to 30 years.	i, ii	5.4.1.
Fixed Terrestrial Services	Dealing with congestion / encouraging efficient use	ComReg will review the spectrum usage and requirements of licensees to ensure the continued efficient use of spectrum.	i, ii, iii,	
		ComReg will review its current licensing strategy to ascertain if there are circumstances where the licensing of a block of spectrum may lead to improved efficiencies and if so, how and in what spectrum, could we facilitate this type of licensing approach.	i, ii, iii	5.5.1.
		Encourage operators to use the latest technology in order to ensure efficient use of the spectrum.	iii, ii	
		Review fixed links frequency plans with a view to rationalisation where possible.	i, ii, iii	
		Study sharing implications between Satellite and Fixed services in the 4 GHz band which is currently unused in Ireland. This band could be used for the provision of further national networks.	i, ii, iii	

Service	Key Issues	Strategy	Objectives	Section
Fixed Terrestrial Services		Study the use of 26 GHz band with a view to developing it for point to multipoint systems. (Also see Wireless Broadband Services below).	i, ii	5.5.1.
		Study the potential and demand for new fixed links bands, e.g. 58 GHz bands.	i, ii	
		Study introduction of administrative incentive pricing to encourage use of more bandwidth efficient technologies in congested bands / areas.	iii	
		Clear all remaining links from the old 1.5 GHz band to allow future introduction of Terrestrial Digital Audio Broadcasting (TDAB).	i, ii, iv	
Wireless Broadband Services	Bringing Irish broadband penetration into line with other EU countries.	Continue work of Fixed Wireless Access Local Area (FWALA) Operators Forum, the objectives of which include promoting FWA as a viable & reliable alternative platform for the provision of electronic communications services.	i, ii	5.5.1.
		Continue to identify appropriate spectrum allocations, both licensed and licence-exempt, for Wireless Broadband Services which are supported, or likely to be supported, by ready availability and choice of equipment.	i, ii, iii, iv	
		Encourage introduction of new cost-effective wireless technologies.	i, ii, iii	
		Seek opportunities for further licence-exempt FWA services.	i, ii	
		Carry out a comprehensive review of the 26 GHz band in early 2005 in order to rationalise the use of the band and improve its usefulness to a range of services.	i, ii, iii, iv	

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Executive Summary Continued

Service	Key Issues	Strategy	Objectives	Section
Licence Exempt Services	Development of new SRD products, applications and technologies	Facilitate new Short Range Device (SRD) applications by making spectrum available where appropriate for such applications, subject to demand and technical feasibility.	i, ii, iv	5.6.2.
	Other Licence exempt services	Continue to exempt services from requiring a licence where this is appropriate in the Irish context.	i, ii	
	Impact of short-range licence-exempt applications and technologies	Monitor and contribute to international developments in licence-exempt applications and technologies and ensure these can be accommodated in Ireland.	i, ii	
Aeronautical & Maritime	Maintaining safe and effective aeronautical and maritime communications	Continue to provide protection from interference for aeronautical and maritime safety of life services.	ii, iv	5.7.1. 5.8.1.
	Availability of spectrum for new applications	Promote the use of spectrum efficient technologies in the aeronautical and maritime bands, thereby maximising the spectrum available for growth and new applications.	i, iii	
		Ensure spectrum is available for use by new emerging systems, in line with international requirements.	i, ii, iv	
		Review fees associated with these licence types.	iii	
Radar and Radio-navigation	Efficient and effective use of spectrum for radar and radionavigation applications	ComReg will introduce a once-off licensing fee for these services.	iii, iv	5.7.1. 5.8.1. 5.13.1.

Service	Key Issues	Strategy	Objectives	Section
Satellite Services		To review current satellite legislation with a view to adapting it to cover future licensable services such as High Density Fixed Satellite Services (HDFSS). The review will ensure that the spectrum efficiencies offered by HDFSS are reflected in a new fee structure that is proportionate to the existing fee structure.	i, ii, iii, iv	5.9.1.
		Maintain an awareness of international developments.	ii, iv	
		Where possible, ComReg intends to exempt most low interference risk terminals which are typified by operating in harmonised spectrum to harmonised standards.	i, ii	
Defence		Maintain an awareness of international civil/military issues.	ii, iv	5.10.1.
		Liaise with the Defence forces as required to resolve spectrum related concerns.	i, ii, iii	
Business Radio		Continue to support the requirements of the Private Mobile Radio (PMR) industry and users.	i, ii	5.11.1.1.
		Encourage the development and use of new technologies.	ii, iii	
		Review frequency bands with a view to ensuring there is adequate spectrum for the introduction of new and emerging digital technologies.	i, ii	
		Continue to monitor PMR installations to ensure compliance with licence conditions.	iv	
		Consult on proposals to introduce a new national business radio licence scheme for the provision of services to third parties.	i, ii, iii	

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Executive Summary Continued

Service	Key Issues	Strategy	Objectives	Section	
Business Radio	Meteorological service protection	Introduction of GSM for Railways (GSM-R) service: Subject to demand, ComReg may consider appropriate licensing options for the GSM-R service.	i, ii	5.11.1.4.	
Public Safety Services		Ensure spectrum is available to meet the future needs of the emergency and law enforcement services.	i, ii	5.11.1.5.	
		Ensure spectrum is interference free.	ii, iv		
Radio Experimenters (Amateurs)		Make frequency bands available to support the needs of experimenters, in line with international developments.	i	5.12.1.	
Science Services		Liaise with Met Éireann 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. Remain appraised of possible means of reducing unwanted emissions to protect Radio astronomy, Frequency and Time Services and other passive services.	i, ii, iv ii, iii, iv		
		Continue to offer a high degree of protection to the Meteorological services, in view of their use in the safeguarding of human life and property.	ii, iv	5.13.1.	
		Introduce a licensing scheme for meteorological radars.	i, ii		
		Continue 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.	ii, iv		
Other Services		Wireless Public Address System	Introduction of a new service to meet the needs of religious and other community organisations.	i, ii, iii	5.14.1.

3

USING THIS DOCUMENT

SPECTRUM MANAGEMENT STRATEGY STATEMENT 2005 -2007

Commission for
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3

Using This Document

Readers are referred to detailed background information relating to ComReg's current approach to spectrum management and options for the future, contained in the consultation document³ and response to that consultation⁴. To keep this document succinct the information given in those two documents has not been repeated here.

The remainder of this document comprises the following:

Chapter 4 summarises the considerations taken into account in formulating this spectrum strategy. This includes the key drivers affecting future spectrum demand, ComReg's wireless vision for 2010, spectrum as a contributor to Ireland's national competitiveness, spectrum as a vehicle for innovation, the value of spectrum, liberalisation options and the use of market mechanisms for spectrum management.

Chapter 5 presents an overview of ComReg's key strategic goals for the radio spectrum over the next five years and outlines ComReg's strategy for managing the radio spectrum in general and for specific services in detail.

Chapter 6 is a Glossary of terms used.

Four Annexes have been provided with background information as follows:

Annex 1 summarises ComReg's role within the national framework and legislation for spectrum management.

Annex 2 presents a summary of the economic contribution arising from the main uses of radio spectrum in Ireland, in terms of Gross Domestic Product (GDP), employment and benefits to industry and consumers.

Annex 3 looks at the role of spectrum management and how spectrum has been apportioned between services and gives a breakdown of individual licences issued by ComReg up to the end of May 2005.

Annex 4 presents two potential future market scenarios, reflecting differing degrees of growth in demand for radio spectrum. The scenarios have been refined in the light of comments received during the consultation and used to develop ComReg's Wireless Vision for 2010, summarised in Chapter 4 and presented in detail in this Annex.

³ ComReg Document 05/01 "Preparing the radio spectrum management strategy for 2005 – 2007."

⁴ ComReg Document 05/36 "Response to the consultation on a strategy for management of the radio spectrum."

4

CONSIDERATIONS IN FORMULATING A SPECTRUM STRATEGY

SPECTRUM MANAGEMENT STRATEGY STATEMENT 2005 - 2007

4

Considerations in Formulating a Spectrum Strategy

4.1. Introduction

ComReg has a legal requirement to ensure the efficient management and use of the radio spectrum. To achieve this objective, ComReg has developed a strategy with regard to radio spectrum which includes a number of strategic goals, namely:

- Facilitating access to radio spectrum, particularly for innovative technologies and services;
- Maximising the economic and social benefits arising from the use of radio spectrum;
- Promoting the efficient use of scarce radio spectrum resources; and
- Ensuring compliance with international requirements and the avoidance of harmful interference.

This strategy is updated periodically to reflect changes in markets, technology and demand for radio spectrum for different applications. A key purpose of the strategy is to consider future demand for spectrum and whether any changes to the way spectrum is managed and allocated to different services are required to meet demand growth. The scenarios are presented in Annex 4.

The strategy is developed in the context of the global, regional (European) and national regulatory framework that governs spectrum use in Ireland. The strategy comprises a number of strategic goals in relation to each of the above areas along with a number of issues in relation to specific radio services that require consideration in order to meet the broad strategic objectives. The strategy is presented in Chapter 5 of this document. The remainder of this Chapter addresses the key issues that have been considered by ComReg in developing this strategy.

4.2. Key Drivers affecting future spectrum demand

A key element of ComReg's spectrum strategy is to ensure as far as possible that sufficient spectrum is available to meet future demand. Spectrum demand is a function of the demand for the services and applications that require spectrum, but is also influenced by technological developments that enable spectrum to be used in a more efficient manner. For example, the migration from analogue to digital TV broadcasting enables several TV programme services to be simultaneously transmitted using the same amount of spectrum as a single analogue programme service.

Demand for spectrum is also somewhat dependent on substitutional effects driven by technical and/or economic limitations of other non-wireless technologies, for example the use of fixed wireless access technologies to improve the availability and reach of broadband services. Wider social and economic developments affecting people's approach to work and leisure will also impact on demand, particularly the extent to which people wish to communicate on the move and the desire for multi-room utilisation in both the home and in the workplace.

Drivers of spectrum demand can be grouped into five main categories, namely:

- Markets;
- Technology;
- Social & cultural;
- Economic;
- Legal & regulatory.

The main drivers and constraints arising from each of these are discussed in the following sections.

4.2.1. Market Drivers

The key market drivers that are likely to impact on future radio spectrum demand in Ireland are:

- (i) **Convergence**, i.e. the deployment of multiple digital media such as broadcasting, telecommunications and information technology to deliver integrated multimedia content and services;
- (ii) **Demand for broadband fixed services**, particularly in areas where non-radio alternatives are not technically or economically viable;
- (iii) **Demand for multi-channel TV and radio**, particularly if mobile or portable reception is required, necessitating a terrestrial transmission platform;
- (iv) **Demand for mobile multimedia content**, particularly delivery of high volumes of audiovisual or other high bandwidth content which could create demand for further mobile spectrum or access to alternative delivery platforms such as broadcasting technologies.

4.2.2. Technology Drivers and Enablers

New technology developments are taking place that could have a significant bearing on how spectrum is used in the future to deliver electronic communication technologies. Some of the key developments include:

- Convergent networks and devices that combine fixed, mobile and broadcast transmission media enabling different content and services to be delivered to the same terminal using the most appropriate choice of platform (see above);
- Improved spectrum efficiency, enabling higher volumes of data to be transmitted in a given amount of spectrum (e.g. technologies such as Ultra Wide Band (UWB) offer the potential to carry very large amounts of data over short distances);
- Cognitive and software defined radios that can adapt dynamically to different environments depending on time and location, frequency availability etc.;
- The increasing practicality of utilising bands located higher in the frequency spectrum.

4.2.3. Social / Cultural Drivers

Radio spectrum has a crucial role to play in supporting key social objectives, such as ensuring widespread access to broadband services and public service broadcasting content or the efficient delivery of public services such as health and law enforcement. Broadcasting has played a key role in promoting national culture and language while new opportunities for regional and specialist programming will arise with the introduction of digital services.

There are a number of areas where social, cultural and public policy issues might influence demand for radio spectrum. Two areas where these factors are particularly relevant are extending the availability of broadband access and future broadcasting services. To some extent these are linked since digitisation of television may provide opportunities to extend future broadband availability either by using the digital TV platform itself or by making use of some of the UHF spectrum to extend broadband access in rural areas.

4

Considerations in Formulating a Spectrum Strategy Continued

Three other drivers that must be considered are:

- The need to ensure access to spectrum for government services;
- The use of radio spectrum to improve traffic management and public transport;
- Environmental issues related to infrastructure sharing.

4.2.4. Economic Drivers

Many of the services that use the radio spectrum are dependent on discretionary spending by consumers and demand is therefore likely to be influenced by levels of disposable income and the general state of the economy. Ireland's rapid economic growth over the last decade has undoubtedly contributed to the boom in mobile communications and continuing growth is likely to drive demand for new services and content. Lifestyle and employment changes will also have a bearing, for example increased working from home (i.e. teleworking) could spur demand for more Broadband connections.

According to the most recent Central Bank Quarterly Bulletin, Irish GDP is projected to grow by 5.5 per cent in 2005 and to continue at a broadly similar pace in 2006. Overall consumer price inflation is expected to average about 2.5 per cent in 2005 and is projected to rise to 2.75 per cent in 2006⁵. According to the Central Bank report, there are signs that consumer expenditure has strengthened this year, albeit at a gradual rate and a positive outlook for labour market performance may support the growth in disposable incomes and help to underpin positive consumer sentiment. This somewhat faster pace of consumer spending growth is expected to strengthen further next year, according to the analysis. The environment for growth in the wireless sector therefore is likely to remain strong taking into consideration business confidence and lifestyle changes that place a premium on convenience and mobility. This could be compounded by increasing levels of traffic congestion, leading to increased use of tele working and driving demand for mobile and broadband services.

4.2.5. Legal and Regulatory Drivers

Ireland's legislative framework for wireless services is largely driven by European developments, such as the introduction in 2003 of the new regulatory package. The main emphasis of this framework is the promotion of competition and a single European market in electronic communications, however there is increasing interest at the European level in liberalising spectrum management to support innovation and the development of new wireless products and services.

Spectrum liberalisation provides the potential to use spectrum for more than one purpose and is likely to be a key enabler of technology convergence. For example, in the future spectrum currently used for broadcasting might also be used to support mobile services (such as multimedia content delivery), or spectrum currently used to deliver fixed access services could also provide mobility. These possibilities raise many issues for incumbent users of radio spectrum and spectrum management agencies alike⁶.

⁵ Source: Central Bank Quarterly Bulletin 3 (July) 2005

⁶ i.e. current users of spectrum operate with knowledge of alternative uses for occupied spectrum and potential use of adjacent band spectrum.

In the next 2-5 years it is expected that a number of new Bills relating to the regulation of the electronic communications sector will be enacted. These include a new Telecommunications (Miscellaneous Provisions) Act, a new Radiocommunications Act, which will replace the Wireless Telegraphy Acts 1926-1988, and a new Broadcasting Act. The implications of this new legislation will be covered in future strategy documents.

4.3. ComReg Wireless Vision for 2010

4.3.1. Introduction

Based on the responses to the scenario analysis presented in consultation document 05/01, ComReg has assessed the potential spectrum demand trends for various services over the next five years. This is intended to represent a plausible vision of a future where a substantial increase in spectrum demand would arise. A key element of ComReg's spectrum strategy will be to provide, as far as practicable, the flexibility to accommodate such demand should it arise. The scenario analysis on which the assessment is based is presented in Annex 4.

4.3.2. ComReg Vision for Specific Wireless Services

- **Mobile:** Widespread demand for high speed mobile data means existing 2G and 3G spectrum is fully utilised and pressure is growing for access to other bands such as the 2.6 GHz band which is still being used by MMDS services.
- **Wireless Broadband Services:** Demand for "wireless DSL" type services means that the 3.5 GHz band in particular is heavily used and has reached saturation in some urban areas. 10 GHz is used in these areas to provide additional capacity and 5.8 GHz is widely used in smaller towns and villages. 26 GHz is increasingly used to serve business users and trial services are underway at 40 GHz offering STM-1 or higher data rates. The fixed link bands are heavily used to provide backhaul in support of wireless broadband services.
- **Broadcasting:** Digital TV is now in the majority of homes, many of which have multiple television sets and rely on a mix of platforms for reception. Regional trials of mobile TV have been successful and there is now pressure from broadcasters and mobile operators to expedite analogue switch off to free up spectrum for national mobile TV multiplexes. DAB in Band III is offering a range of new, specialist radio channels and L-band is being used to deliver mobile multimedia content to the latest generation of multi-mode phones. Portable and mobile content TV and other audio / visual material receivable on hand-held devices is a big growth market and there is pressure for access to UHF TV channels to deliver services to hand-held DVB-enabled mobile phones.
- **Satellite:** Satellite is being used to deliver broadband backhaul to rural areas, which are then served by licensed wireless networks or licence exempt wireless networks, typically in the 5.8 GHz band.
- **Fixed links:** There is strong growth in all bands above 15 GHz to provide access infrastructure links for mobile and FWA networks. Bands below 15 GHz are congested as they are heavily used for the provision of national broadband networks in support of communications networks.
- **Licence Exempt Spectrum:** In addition to demand for licence exempt wireless broadband services, there is also increasing demand for spectrum to accommodate short range applications for broadband connectivity, RFID applications and automotive applications such as collision avoidance radars.

4 Considerations in Formulating a Spectrum Strategy Continued

4.3.3. Summary of Anticipated Spectrum Demand trends

The following table summarises the anticipated trends in demand for radio spectrum by various sectors, based on the vision described above.

- Key:
- ↑↑ = high demand growth anticipated
 - ↑ = moderate demand growth anticipated
 - ↔ = little change anticipated
 - ↓ = moderate decline anticipated
 - = demand not anticipated

	Below 3 GHz	3 – 15 GHz	Above 15 GHz
Mobile	↑	↔	-
Wireless Broadband	↑	↑↑	↑
Broadcasting (terrestrial)	↔	-	-
Satellite	↔	↔	↔
Fixed Links	↓	↔	↑
Licence Exempt	↑	↑	↑

4.4. Spectrum as a Contributor to Ireland’s National Competitiveness

Ireland possesses some unique advantages compared to its European neighbours when spectrum is considered as a national resource. On the one hand, we have a well-developed high-tech sector with many leading global IT and telecoms companies having facilities here. On the other, Ireland’s position on the western edge of Europe and its relatively low population density, mean that the radio frequency spectrum is relatively uncongested. For the most part, frequencies can be made available as and where required. These natural advantages mean that Ireland is ideally located as a manufacturing base and/or test-bed for companies wishing to test, develop and manufacture new products and services for global markets.

However, if this potential is to be realised, certain challenges must be overcome. While the traditional methods of frequency allocation and assignment within the accepted national and international framework are generally perceived as fair and equitable (both between operators or end-users, and between different countries), they have their disadvantages. They can be slow and inflexible: new assignments at international level can take anything from 3 to 10 years to achieve, while national licensing for a new, innovative service can take from 1 to 3 years. In addition, in assigning spectrum for new services there are uncertainties involved in assessing the level of demand. This can result in inefficiency, in the economic sense: spectrum does not end up with those users who place the highest value on it. It can also stifle innovation, by favouring incumbents over new entrants, since any delay in licensing new services tends to favour the status quo⁷.

⁷ See, for example, M. Cave, "Review of Radio Spectrum Management", March 2002, available at www.ofcom.org.uk

A recent study for the European Commission⁸ found that current methods of spectrum management could not be relied upon to distribute spectrum efficiently. They generated less economic value than they could, and so deprived EU citizens of economic benefits. The study recommended the harmonised introduction, throughout Europe, of both secondary trading (the transfer of spectrum usage rights between parties in a secondary market) and liberalisation (the relaxation of restrictions on services or technologies associated with spectrum usage rights as well as the possibility of reconfiguring usage rights).

A report⁹ by Forfás to the Minister for Enterprise, Trade and Employment identified wireless communications as a potential area of high growth, and recommended actions to promote the development of wireless as a sustainable internationally traded sector from Ireland. These actions included a set of recommendations on accelerated liberalisation of spectrum management. Both in response to this, and as part of its overall responsibility to ensure efficient spectrum management and promote innovation, ComReg has taken a number of initiatives in this area:

- After public consultation, ComReg has decided to extend and liberalise its test licensing regime to include commercial trial licences and to extend the possible duration of both test and trial licences. The expanded test licensing regime will be suitable for use for tests and trials of innovative technologies and services including Ultra Wide Band (UWB) trials.
- This paper contains proposals for how the issues of spectrum liberalisation and trading in spectrum rights of use might be addressed.
- Through its Forward Looking Panel¹⁰, ComReg has established links with third-level colleges and universities, which it intends to use to spread awareness of the availability of spectrum for test purposes.

ComReg will continue to promote the use of spectrum for R&D purposes, not just as an end in itself but as an input into the growing applications in the software sector. The Forfás report recommended that Ireland should focus its future development on its existing established strengths in operations support systems (OSS), security and the billing and transaction management area of the wireless sector. It also recommended that Ireland had the potential to expand its core strengths into certification and hosting activities, exploiting current activities in middleware to create a European hub for the emerging mobile application hosting industry. The realisation of this concept will require a concerted approach from various agencies and departments, including ComReg, Forfás, IDA, Science Foundation Ireland and the third-level education sector. Availability of spectrum is only one input; other factors, such as Ireland's competitive corporate tax regime, will also play their part. ComReg looks forward to co-operating closely with other agencies, and would welcome further suggestions on how spectrum use can be facilitated and encouraged as a driver of international competitiveness for Ireland.

⁸ "Study of conditions and options in introducing secondary trading of radio spectrum in the European Community", Analysis, DotEcon and Hogan & Hartson; available at: http://europa.eu.int/information_society/policy/radio_spectrum/docs/ref_info/secondtrad_study/secondtrad_final.pdf

⁹ Wireless Communications: An Area of Opportunity for Ireland, April 2004, available at: http://www.forfas.ie/publications/forfas040401/forfas_wireless_report_040401.pdf

¹⁰ The ComReg Forward Looking Panel consists of senior-level external industry advisors who meet to help guide and assist the forward-looking programme. The panel meets in a workshop setting two to three times a year to review and help develop work carried out under the programme, to propose new topics to be addressed, and to draw attention to potential new issues.

4

Considerations in Formulating a Spectrum Strategy Continued

4.5. Innovation

Creating a regulatory environment supportive of innovation in new electronic communications services is critical in positioning Ireland to realise the benefits of a vibrant telecommunications industry. This philosophy underpins much of ComReg's approach to spectrum management. Two recent examples where this has been put into practice include:

- the introduction of licence exempt wireless broadband access in the 5.8 GHz band (5725 – 5875 MHz);
- the test and trial Licence scheme¹¹, introduced after public consultation in May 2005, is a new licensing regime for radio service and technology trials which will bring Ireland to the forefront as an ideal location for research and development. One of the key features of the scheme is that it allows innovative new wireless services to be offered to the public on a trial basis. This will allow new service concepts to be tested in a realistic environment at an early stage of development, ensuring that subsequent commercial offerings are properly tailored to meet the needs of users.

4.6. Placing a Value on Radio Spectrum

The value of radio spectrum derives from its utility and its scarcity. Because of interference between radio emissions use by one user can deny use by another. In addition some frequencies are more valuable than others because of their propagation characteristics and because particular bands are reserved for particular uses. For example, frequencies in the 300 MHz to 3 GHz range are currently generally regarded as the most valuable because they support wide area mobile applications which are highly valued by users because of the functionality they offer and because there are few, if any, realistic alternatives.

As a key input to revenue-generating operations like telecommunications and broadcasting, radio spectrum has a tangible economic value to many of those who use it. This value becomes most apparent when radio spectrum is auctioned, as is the case in many countries around the world. In respect of commercial uses of the spectrum this value derives from two factors. First, there are the additional economies of scale and profits that an operator can earn by supporting more users or offering a better quality service as a result of having more spectrum. Secondly, infrastructure and other costs may be reduced if additional spectrum is made available to a user. For non-commercial users valuation of the spectrum is more problematic because the value of the outputs they produce is less tangible. For example, use of mobile radio enables the emergency services to respond more quickly to emergency calls, the value of which may be manifested in terms of lives saved, criminals apprehended and fires extinguished.

ComReg has a legal obligation to ensure the optimal use of radio spectrum and levies fees on spectrum use in order to support this objective. Optimal use of spectrum depends on a number of factors, including:

- demand for spectrum in particular bands and/or geographic areas;
- public policy considerations;
- economic and market considerations;
- social considerations;
- technology; and
- legal factors (e.g. European or international obligations).

¹¹ See ComReg Document 04/115: Opportunities for Trialling Wireless Services and Technologies in Ireland.

In general, spectrum fees should be set at a level that promotes technical efficiency, encourages the rollout of infrastructure in rural areas and supports the development of innovative services. ComReg is considering whether its current fee structure adequately supports these objectives and will be consulting on spectrum fees in 2005.

4.7. Liberalisation of Spectrum Management

In common with other European regulators, ComReg is reviewing its approach to some aspects of spectrum management to ensure that they are compatible with the evolving electronic communications markets and technologies. In particular, ComReg recognises that convergence between the fixed, mobile and broadcast sectors may favour a more flexible approach to spectrum allocation and licensing. "Liberalisation" of spectrum management by removing regulatory constraints that are not required to avoid harmful interference or to meet specific policy objectives could provide such flexibility.

Examples of liberalisation may include relaxing the rules relating to the transfer of licences between undertakings or the types of service that can be provided in particular parts of the spectrum. In the short term, ComReg is considering the introduction of a new National Business Radio licensing scheme for the provision of services to third parties which, in comparison with existing business radio licences, will allow licence holders substantially greater flexibility in how they use the spectrum. In the longer term, there may also be opportunities to provide greater flexibility in the services that can be delivered in fixed, mobile and broadcast bands, particularly where the technologies deployed in these bands are capable of addressing different market sectors.

ComReg continues to study the issue of spectrum liberalisation and plans to consult on this issue in 2005/2006.

4.8. Use of Market Mechanisms for Spectrum Management

4.8.1. Introduction

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 the 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 regulator (although the regulator still has a role to ensure that the traded spectrum continues to be used in an appropriate manner).

4.8.2. ComReg Position on Market Mechanisms

In the consultation document ComReg compared a number of different market mechanisms and the advantages and disadvantages of each mechanism. The comparison included comparative selection procedures (otherwise known as 'beauty contests') and auctions.

4

Considerations in Formulating a Spectrum Strategy Continued

ComReg does not at this stage favour any one specific approach for awarding spectrum rights, but prefers to consider each case on its own merits. ComReg will use auctions as an alternative to comparative selection procedures for future spectrum assignments where this is appropriate. For example, an auction has been proposed for the award of wideband digital mobile radio services in the 400 MHz and 900 MHz bands.

4.8.3. ComReg Position on Spectrum Trading

Spectrum trading allows a licensee to transfer the right to use all or part of the licensed spectrum, usually in return for some financial consideration. Trading can take several forms that includes transfer of licences, reconfiguration, partial trading of spectrum, spectrum leasing and change of spectrum use. These variants, their operation, advantages and disadvantages, as discussed in the consultation document, can be applied either individually or in combination, e.g. partial trading of spectrum may or may not involve reconfiguration or change of use, depending on the prevailing rules and the wishes of the trading parties.

ComReg will be studying these concepts in relation to trading and change of use as part of its broader work on spectrum liberalisation. Although some aspects of this require revision of the primary legislation (Wireless Telegraphy Acts), ComReg will be seeking opportunities to liberalise specific frequency bands or services where this would provide benefits and could be done within the scope of existing legislation. ComReg expects to consult on specific proposals later in 2005.

5

STRATEGY FOR MANAGING THE RADIO SPECTRUM AND SPECIFIC SERVICES

SPECTRUM MANAGEMENT STRATEGY STATEMENT 2005 - 2007

Commission for
Communications Regulation

5

Strategy for Managing the Radio Spectrum and Specific Services

5.1. Key Strategic Goals for Spectrum Management

5.1.1. Facilitating Access to Radio Spectrum

ComReg aims to:

- ensure flexibility and ease of access to radio spectrum to accommodate technological advances and market factors in order to leverage Ireland's competitive advantage;
- adapt the allocation of, and access to, the spectrum resource to provide spectrum that best meets the needs of the user;
- be a European leader in the adoption of new and innovative wireless services;
- support and promote innovation, research and development in new radiocommunication techniques, spectrum-based services and applications;
- review current procedures with a view to bringing licence duration more in line with investment cycles, noting that a radio licence does not confer ownership nor a continued right to a particular radio frequency;
- ensure that current licensing schemes are appropriate and simple to use and administer so that licences can be issued quickly;
- continue encouraging and authorising radiocommunication system trials and new technology experiments in frequency bands appropriate to the intended applications and subject to the availability of suitable spectrum.

5.1.2. Maximising Economic and Social Benefits

- ComReg will seek opportunities to promote the use of radio systems to enhance Ireland's international competitiveness and to promote competition at home in infrastructure and services;
- ComReg will continue to consult regularly and widely on spectrum issues in order to have the benefit of industry and other stakeholders' views when making decisions;
- ComReg will continue to ensure that spectrum continues to be available to meet the needs of public safety, emergency services and safety of life services in view of their vital role in the safeguarding of human life, property and national security;
- Where appropriate, ComReg will seek to liberalise the constraints applied to spectrum rights of use, to permit the deployment of alternative technologies or services, where harmful interference does not result;
- ComReg will seek opportunities to promote the take-up of the innovative test and trial licence scheme in order to position Ireland as a manufacturing base and test-bed for wireless system testing and service trials;
- Where appropriate, ComReg will facilitate and encourage the use of wireless technology to support regional development objectives.

5.1.3. Promoting the Efficient Use of Scarce Spectrum Resources

- ComReg seeks to optimise the use of the spectrum resource by encouraging the use of spectrum efficient radio systems and the use of the most appropriate frequency band for each application in order to maximise spectrum usage in critical frequency bands;

- ComReg is considering further arrangements for the introduction of Administrative Incentive Pricing in order to encourage efficient use of the spectrum, with the intention of bringing the demand for spectrum into equilibrium with its supply;
- ComReg is considering opportunities to permit one or more forms of trading in spectrum rights (spectrum trading) in relation to specific services, to test its appropriateness and operation in the Irish market;
- ComReg will work with the Government to expedite the introduction of new legislation to facilitate more effective and flexible use of radio spectrum.

5.1.4. Ensuring Compliance with National and International Requirements and the Avoidance of Harmful Interference

- ComReg works to protect Ireland's national interests when harmonising and co-ordinating spectrum utilisation with other countries and regional and international organisations;
- ComReg is committed to planning and managing the utilisation of the spectrum resource in accordance with both national and international legislation;
- Where appropriate, ComReg will require compliance with international agreements on frequency usage and technical standards as a requirement for spectrum access, recognising that these agreements are necessary for harmonious system operation, efficient spectrum management, spectrum utilisation, compatibility, competitiveness and avoidance of interference;
- ComReg will continue to represent and promote Irish positions 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.

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

5.2. ComReg Strategy at the International Level

5.2.1. Introduction - The International and Regional Dimension

Radio frequencies extend beyond national borders so spectrum management requires an in-depth knowledge of, and involvement in, European and global spectrum management developments. Much of the radio spectrum is planned internationally and in some cases this constrains how specific frequencies or frequency bands may be used. This is particularly so in the aeronautical and maritime sectors, where, because of the global nature of these services, ships and aircraft must use specific frequencies for navigation and communication purposes. In addition, there are a number of internationally harmonised frequencies for commercial radio systems such as cellular (mobile) phones. The TV and radio broadcast bands have been harmonised for many decades, to facilitate co-ordination between neighbouring countries and the development of consumer markets. Other parts of the spectrum may be used to meet specific national requirements, so long as these comply with the requirements of the ITU Radio Regulations.

The role of each of the international bodies was described in detail in the consultation document. Figure 1 illustrates the International Spectrum Management Framework within which ComReg operates:

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Strategy for Managing the Radio Spectrum and Specific Services Continued

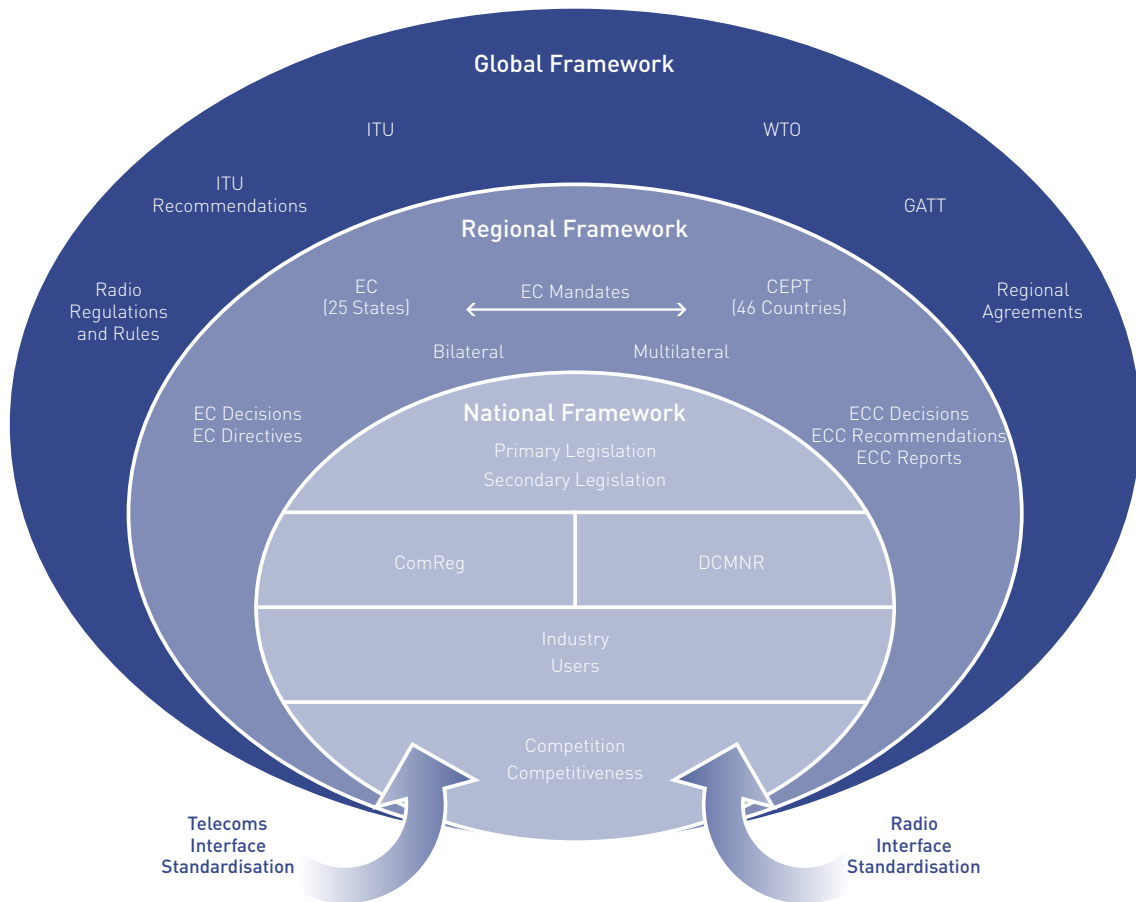


Figure 1: International Framework for Spectrum Management

Within EU Member States, there is a three level regulatory structure governing radio spectrum usage, comprising global, regional (European) and national layers, as indicated in Figure 1 above. Global regulation is primarily the remit of the International Telecommunications Union (ITU), while regional regulatory remits lie with the European Union (EU) and the European Conference of Post and Telecommunications Administrations (CEPT). These bodies define the broad framework within which all spectrum users must operate, and in some cases have developed harmonised approaches to spectrum use in order to facilitate international services, open markets and minimise the risk of interference between users.

In order to ensure the interests of Ireland are protected, ComReg plays an active role at both a global and regional (European) level. ComReg’s proposed strategies within the global and regional frameworks are highlighted below.

5.2.2. ComReg Strategy at the Global Framework Level

ComReg's strategy at the Global Framework level includes:

- supporting harmonisation of global spectrum allocations where the harmonisation fits in with Ireland's strategic vision;
- ensuring that Irish interests as a whole are promoted;
- participating actively in key ITU activities in so far as available resources permit to support greater efficiency in its operations;
- supporting the development of relevant international standards;
- taking an active role in the work of international meetings in line with ComReg's legislative mandate, when invited by the Minister to contribute through ComReg's specialist spectrum management expertise.

5.2.3. ComReg Strategy at the Regional Framework Level

At the Regional Framework level ComReg's strategy is:

- to work within European frameworks to ensure that the availability of spectrum and regulatory practices are in line with ComReg's objectives, particularly where they bring benefits to consumers in terms of increased choice, more competitive pricing and better quality services;
- to implement, to the maximum extent possible, the CEPT/ECC Table of European Common Frequency Allocations (ECA)¹² in order to support regional harmonisation, noting that implementation of the ECA is currently under review within CEPT;
- where appropriate, to implement ECC Decisions;
- to influence and support the development of harmonised standards;
- to improve co-ordination of frequency assignments with other administrations, through a harmonised European or global approach or by bilateral or multi-lateral agreements, as appropriate.

5.3. Public Mobile Services

Mobile communications is one of the fastest growing sectors of telecommunications with mobile phone penetration rates in Ireland now standing at 94%¹³. The three 2G cellular operators licensed in Ireland each have a total of 2 x 21.6 MHz of assigned spectrum, and the three 3G operators each have 2 x 15 MHz. 59% of the available 2G spectrum¹⁴ and 62% of the available 3G spectrum¹⁵ has been licensed.

Ireland is unusual in a European context in that it has large quantities of unused spectrum in the GSM and 3G bands. In the GSM 900 band the 2 x 10 MHz E-GSM spectrum is unassigned as is a further 2 x 3.8 MHz in the core GSM 900 band. Similarly, in the GSM 1800 band there is 2 x 26.4 MHz of spectrum yet to be assigned. In total, Ireland has 2 x 40.2 MHz of available GSM spectrum.

¹² See CEPT ERC Report 25, The European table of frequency allocations and utilisations covering the frequency range 9 kHz to 275 GHz (available at www.ero.dk).

¹³ ComReg Quarterly Key Data, March 2005.

¹⁴ Assumed to be 2 x 35 MHz available in the GSM900 band and 2 x 75 MHz in the GSM1800 band

¹⁵ Assumed to be 2 x 60 MHz paired plus 25 MHz unpaired (excludes spectrum identified for self-co-ordinated systems)

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Strategy for Managing the Radio Spectrum and Specific Services Continued

In June 2005, ComReg invited applications for the fourth 3G licence¹⁶. The licensee will be offered core 3G spectrum comprising of 2 x 15 MHz of paired spectrum plus 5 MHz of unpaired spectrum, the same as previously offered in the original competition in 2001/2002. In order to achieve a fair level of competition with the incumbent operators, additional spectrum in the 900 MHz and 1800 MHz bands will also be made available, on the basis of demonstrable need, to a successful Applicant who is a new market entrant. This spectrum will comprise up to 2 x 7.2 MHz of spectrum in the 900 MHz band, and up to 2 x 6.0 MHz in the 1800 MHz band.

5.3.1. ComReg Strategy for Public Mobile Services

5.3.1.1. Future Expansion Spectrum for 3G Mobile Services

- ComReg is participating in European work on the designation of the 900 and 1800 MHz GSM bands for 3G mobile (work on an ECC Decision is expected to commence in 2005) and will consult with all interested parties on the implications of any proposals.
- ComReg plans to consult with industry to develop a coherent strategy to facilitate the development of 3G services in the 2.6 GHz band subject to market demand whilst accommodating any ongoing requirement by MMDS operators and their customers;
- ComReg is considering the future of the band 2010 – 2025 MHz for other services. Subject to developments in CEPT, ComReg will support the removal of the reference in the relevant ECC Decision, to self provided applications and efforts to achieve a flexible solution for the future use of this band on a harmonised basis subject to market demand.

5.3.1.2. Future Use of Existing Unassigned GSM and 3G Mobile Spectrum

Currently there is unassigned spectrum in the GSM bands (2 x 40.2 MHz) and the 3G Bands (2 x 15 MHz plus 10 MHz). This could change by late 2005 if the fourth 3G licence is taken up.

- ComReg will consider the future of these bands alongside international and wider policy considerations in relation to spectrum liberalisation.
- In particular, ComReg is considering the potential demand for innovative wireless services in these and other frequency bands.

5.3.1.3. Possible Demand for Convergent Wireless Services

- ComReg will endeavour to accommodate requirements for trials of convergent wireless technologies as these arise in appropriate spectrum.

5.3.1.4. Quality of Service

- ComReg will monitor Quality of Service on GSM and 3G networks.

¹⁶ ComReg Doc 05/41 – Licence to provide 3G service in Ireland.

5.4. Broadcasting Services

Broadcasting is a major user of the radio frequency spectrum. Radio Telefis Éireann (RTÉ), the public service broadcaster established under the Broadcasting Authority Act 1960 as amended, provides national radio and television services. The Broadcasting Commission of Ireland (BCI), established under the Broadcasting Act, 2001, is responsible for the authorisation of Irish broadcasting services other than those provided by RTÉ, under the Radio and Television Act, 1988 and the 2001 Act. ComReg is responsible for the allocation, assignment and licensing of the associated radio frequencies under the Broadcasting Acts.

5.4.1. ComReg Strategy for Television and Sound Broadcasting

- monitor the development of digital modulation techniques that have the potential to replace the analogue service with high quality broadcast services in the short wave, medium wave and long wave broadcast bands;
- ensure present operator compliance and protect authorised services from illegal spectrum use;
- prepare positions for ITU Conference RRC-06: ComReg is working with the DCMNR, RTÉ and the BCI in preparation for the forthcoming 2006 Regional Radio Conference to re-plan the broadcast bands III, IV and V, currently covered by the Stockholm Agreement. The frequency plan(s) to be agreed at the RRC will form the basis for VHF/UHF broadcasting in Europe for possibly the next 20 to 30 years;
- As mentioned in the section under Public Mobile Systems, ComReg is keeping an open mind on the issue of MMDS and IMT-2000/UMTS in the 2500 – 2690 MHz band.

5.4.2. ComReg Strategy for the Introduction of Digital Terrestrial Broadcasting in Ireland

- Continue planning and co-ordination in preparation for rollout of DTT. DCMNR has stated that it seeks to facilitate the development of a free-to-air offering of nationally broadcast programming on digital television platforms in the medium term. DCMNR has also stated that the declaration of a specific date as an 'analogue switch-off date' can be a useful means with which to inform citizens about changes in the broadcasting environment and that analogue switch-off will be expected to result in a minimum of inconvenience for viewers.
- ComReg will continue to monitor government policy, market and technology developments in this area and will review spectrum options for DVB and/or DAB based delivery of content to mobile platforms and hand-held devices accordingly.

5.5. The Terrestrial Fixed Services

The Terrestrial Fixed Services can be divided up into two main groups:

- Point-to-Point Links;
- Point-to-Multipoint systems.

Point-to-Multipoint systems can be further subdivided into:

- Point-to-Multipoint links;
- Fixed Wireless Access (FWA).

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Strategy for Managing the Radio Spectrum and Specific Services Continued

Point-to-point terrestrial links (fixed links) provide communications between two fixed stations with a clear line of sight between them separated by distances typically ranging from a few metres up to 50 kilometres. They are used mainly by telecommunications operators, mobile phone operators, broadcasters, utilities and the emergency services to provide transmission networks which are cheaper to build than fibre based networks. They are used extensively in fixed telecommunications networks both to carry trunk traffic and to provide broadband access networks. As a result, fixed links play a vital role in the development of a competitive telecommunications industry in Ireland.

Point to multipoint systems provide communications between a central base station, hub or node and 2 or more outstations. These types of systems can be used in support of backhaul networks or for access. Point-to-multipoint links are used by security companies, for alarm monitoring, utilities and telecommunications operators. Point-to-multipoint systems which are used to provide end-user (residential or business customer) access to a telecommunications network are referred to in Ireland as Fixed Wireless Access (FWA) systems. FWA 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. There are three licensing schemes for FWA in Ireland. In 2000, national licences were issued in the 3.5 GHz and 26 GHz band, local area licences are available in the 3.5 GHz, 10.5 GHz and 26 GHz bands and there is also licence exempt spectrum for FWA in the 5.8 GHz band.

5.5.1. ComReg Strategy for Fixed Services

ComReg considers that, in the long term, fibre infrastructure is the most appropriate medium for emerging broadband services, in particular for those networks requiring very high capacity. However, 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 as congestion in the fixed links bands grow, the strategy will be to encourage migration to fibre based infrastructure.

Strategy for the next 2-5 years:

- ComReg will continue to use document 98/14 (as revised) when licensing point-to-point links.
- ComReg will review the spectrum usage and requirements of licensees to ensure the continued efficient use of spectrum;
- ComReg will encourage operators to use the latest technology such as co-channel dual polar (CCDP) equipment or higher modulation schemes in order to ensure efficient use of the spectrum;
- ComReg will study the introduction of administrative incentive pricing to encourage the use of more bandwidth efficient technologies in congested bands/areas;
- ComReg will review its current licensing strategy to ascertain if there are circumstances where the licensing of a block of spectrum may lead to improved efficiencies and if so, how and in what spectrum, could we facilitate this type of licensing approach;
- ComReg will study sharing implications between Satellite and Fixed services in the 4 GHz band which is currently unused in Ireland. This band could be used for the provision of further national networks;
- Reflecting current market uncertainty over future demand for spectrum in the 4 GHz band, ComReg will consider the options available as part of its liberalisation consultation but defer any firm decision on use of the band until the market situation is clearer;

- ComReg will consult on the use of the 26 GHz band;
- ComReg will study the potential and demand for new fixed links bands at higher frequencies e.g. 58 GHz, with a view to introducing a light licensing regime for these bands;
- It is the intention to clear all remaining links from the old 1.5 GHz band to allow future introduction of TDAB in this band;
- ComReg will review the fixed links frequency bands with a view to rationalising the use of these bands where this makes sense and where the disruption to existing licensees is minimal;
- ComReg will continue the work of the FWALA Operators Forum, the objectives of which include promoting FWA as a viable and reliable alternative platform for the provision of electronic communications services;
- ComReg will continue to identify appropriate spectrum allocations, both licensed and licence-exempt, for wireless access services which are supported, or likely to be supported, by ready availability of choice of equipment;
- Promote the Trial Licence scheme¹⁷ as an ideal opportunity to trial new wireless access technologies such as mobile versions of WiMAX, in Ireland.
- To support the national objective of bringing Irish broadband penetration into line with other EU countries, ComReg will:
 - encourage introduction of new cost-effective wireless technologies;
 - seek opportunities for further licence-exempt FWA services.

5.6. Licence Exempt Services

5.6.1. Short Range Devices

Among the most prevalent radio systems in Ireland are Short Range Devices (SRDs). These are uni-directional (one-way) and bi-directional (two-way) low power radio transmitters that serve a multitude of purposes e.g. car door openers, sensors, tagging devices, alarms, wireless microphones and wireless local area networks (WLANs). Additionally, SRDs are used for specialised applications such as Road Traffic and Transport Telematics (RTTT) for the management of roads and traffic e.g. automatic road toll collection and traffic information.

SRDs operate in many frequency ranges in the radio spectrum, from kilohertz, through megahertz to gigahertz frequencies. Due to their low power and localised usage, SRDs are regarded as having a low capability of causing interference. Consequently, they have generally been made exempt from the need for individual radio licences in Ireland, subject to certain technical constraints.

5.6.1.1. ComReg Strategy for SRDs

Short range devices are generally exempt from licensing and operate in frequency bands shared with other users and services on a non-interference, non-protected basis. Effectively, this means that they should not cause interference to other legitimate spectrum users, nor can they claim protection from interference from other spectrum users.

¹⁷ See ComReg Document 05/35: Opportunities for Testing and Trialling Wireless Services and Technologies in Ireland – Application Guidance Notes and ComReg Document 04/115: Opportunities for Trialling Wireless Services and Technologies in Ireland

5

Strategy for Managing the Radio Spectrum and Specific Services Continued

5.6.2. ComReg Strategy for Licence Exempt Services

- ComReg will facilitate new licence exempt services by making spectrum available wherever possible for such applications, subject to demand and technical feasibility;
- ComReg will continue to exempt services from licensing where this is appropriate in the Irish context;
- ComReg will monitor and contribute to international developments in licence-exempt applications and technologies and, where appropriate, will ensure these can be accommodated in Ireland.

5.7. Maritime Services

Due to the global nature of maritime service, the management of the radio spectrum is largely governed by national and international regulations relating to safety of life at sea. The ITU allocates frequency bands for the operation of maritime services and these permit both long range (in frequency bands below 30 MHz and in Bands allocated to marine satellite services) and shorter range communications. In addition, specific frequency channels are allocated as international distress channels and are required to be kept free from interference at all times. There are also a number of bands allocated to marine communications on a national basis.

In Ireland, the Maritime Radio Affairs Unit (MRAU) of the Department of Communications, Marine and Natural Resources is responsible for marine regulation and for ensuring compliance with legislation requiring certain classes of vessels to install a radio¹⁸ which is to be operated by a properly qualified operator.

5.7.1. ComReg Strategy for Maritime Services

- ComReg will continue to provide support to Ireland at international fora to ensure adequate spectrum is available for the maritime services;
- ComReg will continue to prioritise and provide protection from interference to maritime safety of life services;
- ComReg will promote the use of spectrum efficient technologies in the maritime bands, thereby maximising the spectrum available for growth and new applications;
- ComReg will ensure spectrum is available for use by new emerging systems, in line with international requirements;
- ComReg will introduce a licensing regime for radar and radionavigation services. A once-off licence fee of €500 for new stations or modifications to existing stations will be charged to cover co-ordination and notification costs.
- ComReg is planning to review the fees associated with the use of radio on board vessels.

¹⁸ Under the Merchant Shipping (Radio) Rules, 1992, every passenger ship or cargo ship of 300 Gross Tons or above is required to install a radio in compliance with the Global Maritime Distress and Safety System (GMDSS). Similar requirements apply to fishing vessels under the Merchant Shipping Fishing Vessel (Radio Installations) Regulations, 1998.

5.8. Aeronautical Services

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. The ITU Radio Regulations, the International Civil Aviation Organisation (ICAO)¹⁹, Eurocontrol²⁰ as well as national and European legislation all set down requirements applicable to the aeronautical services. Spectrum is allocated internationally for a variety of aeronautical applications, including air-ground voice and data communication, radars and automated landing systems. The safety critical nature of these services and the need to reach high altitudes over great distances means that even distant sources of interference present a major problem hence it is not generally feasible to use aeronautical radio spectrum for other radio services. This, in turn, means that demand for spectrum is determined internationally and there is little scope for individual countries to deviate from the internally agreed spectrum allocations. In Ireland, regulation of the aviation industry is the responsibility of the Irish Aviation Authority (IAA). ComReg's role in this area is limited to administering the issue of radio licences for on board aircraft, for ground based aeronautical transceivers, radar and radionavigation systems.

5.8.1. ComReg Strategy for Aeronautical Services

Aeronautical spectrum is allocated internationally on an exclusive basis and there is little scope for national flexibility. However,

- ComReg will continue to provide support to Ireland at international fora to ensure adequate spectrum is available for aeronautical services;
- ComReg will continue to prioritise and provide protection from interference to aeronautical safety of life services;
- ComReg will promote the use of spectrum efficient technologies in the aeronautical bands, thereby maximising the spectrum available for growth and new applications;
- ComReg will ensure spectrum is available for use by emerging systems, in line with international requirements;
- ComReg is planning to review the current fees attached to aircraft licences;
- ComReg will introduce a licensing regime for radar and radionavigation services. A once-off licence fee of €500 for new stations or modifications to existing stations will be charged to cover co-ordination and notification costs.

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) and outside broadcast (OB) links to meteorological 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).

Satellite services include Broadcasting Satellite Service (BSS), Fixed Satellite Service (FSS), Mobile Satellite Service (MSS), Radionavigation Satellite Services (RNSS).

¹⁹ <http://www.icao.int/>

²⁰ http://www.eurocontrol.int/corporate/public/subsite_homepage/index.html

5

Strategy for Managing the Radio Spectrum and Specific Services Continued

5.9.1. ComReg Strategy for Satellite Services

To encourage the development of the satellite services ComReg will:

- review current satellite legislation with a view to adapting it to cover future licensable services such as HDFSS. The review will ensure that the spectrum efficiencies offered by HDFSS are reflected in a new fee structure and is proportionate to the existing fee structure;
- where possible, exempt most low interference risk terminals which are typified by operating in harmonised spectrum to harmonised standards;
- maintain an awareness of international developments.

5.10. The Defence Forces Use of Spectrum

The Defence Forces have actively utilised radiocommunications from the earliest days and the use of radio spectrum is considered critical to national security. There are no specific service allocations for defence applications in the ITU Radio Regulations as defence communications are recognised as the prerogative of each Sovereign State.

In Europe there is increasing pressure on all elements of spectrum use including civil and military spectrum and consequently there is a need for greater sharing between civil and military applications. Additionally, the increased involvement of national defence forces in combined international aid operations requires compatibility of communications between units.

The Irish Defence Forces, comprising the army, naval services and air corps, uses radio in a variety of ways, most notably in relation to maritime and aeronautical applications.

5.10.1. ComReg Strategy for Spectrum Utilised by The Defence Forces

In the past, ComReg's strategy has been to encourage the use of non-commercial frequency bands and the use of agile radio technologies by the defence forces on a non interference non protected basis, to avoid interference to other users. In continuing this approach ComReg will:

- maintain an awareness of international civil/military developments;
- liaise with the Defence Forces as required to resolve spectrum issues.

5.11. Business Radio Services

Despite the continued rapid growth of cellular telephony, business or private mobile radio (PMR) 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. Business radio is also attractive where the user requires complete control over network operation and costs. The main uses of business radio are for public safety and security (e.g., the Garda Síochána, fire and ambulance emergency services), public utilities (power, water, transport etc.), 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 groups of personnel on the move.

5.11.1. ComReg Strategy for Business Radio

5.11.1.1. Business Radio

ComReg recognises the importance of business radio services and will continue to work closely with the Business Radio industry and users to ensure that the needs of the sector are met. In particular, ComReg will:

- continue to support the requirements of industry and users to ensure that spectrum is available to accommodate new business radio technologies;
- encourage the development and use of new technologies, such as the new ETSI standard for digital business radio (TS 102 361);
- review frequency bands with a view to ensuring there is adequate spectrum for the introduction of new and emerging digital technologies;
- consult on proposals to introduce a new national business radio licence scheme for the provision of services to third parties;
- continue to monitor Business Radio installations to ensure compliance with licence conditions.

5.11.1.2. Wideband PAMR systems

Further to a recent consultation in document 05/31, ComReg plans to proceed with a licensing scheme for wideband systems in the 410 – 430 MHz and 872 – 876 / 917 – 921 MHz bands.

5.11.1.3. Paging

ComReg intends to introduce a licensing regime for paging systems. This would mean that all existing and future paging systems would be licensed and will be subject to a licence fee. The proposed licence fee, at the time of writing is €100 per base station per channel or €3000 per national channel for 3 years.

5.11.1.4. GSM-R

The ECC Decision (02)05²¹ designates the band 876 – 880 MHz paired with 921 – 925 MHz for international and national railway operations (GSM-R). GSM-R systems would provide the radio communications to facilitate the managing and operation of railway traffic and increase its safety. Ireland has yet to adopt this Decision but as these bands are currently unassigned ComReg foresees no difficulty in doing so if there is a request for the provision of GSM-R in Ireland and subject to demand, ComReg may consider appropriate licensing options for the GSM-R service.

²¹ ECC/DEC (02)05 of 5 July 2002 on the designations and availability of frequency bands for railway purposes in the 876 – 880 and 921 – 925 MHz bands. [Available for download from "http://www.ero.dk"]

5

Strategy for Managing the Radio Spectrum and Specific Services Continued

5.11.1.5. Public Safety Services

ComReg will ensure spectrum is available to meet the future needs of the emergency and law enforcement services and that such spectrum is kept free from harmful interference.

To support the Public Safety services ComReg will:

- ensure spectrum is available to meet the future needs of the emergency and law enforcement services;
- ensure spectrum is free from harmful interference.

5.12. Radio Experimenters (Amateur Service)²²

The Amateur Service is specifically recognised by the ITU with a formal service definition in the Radio Regulations and 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.

5.12.1. ComReg Strategy for Radio Experimenters

In addition to the current radio frequency bands allocated to radio Experimenters, ComReg has allocated a number of bands in the Table of Frequency Allocations and will make these available for use on application. These bands are:

- 76 – 81 GHz;
- 122.25 – 123 GHz;
- 134 – 136 GHz;
- 136 – 141 GHz;
- 241 – 248 GHz;
- 248 – 250 GHz.

5.13. Science Services

The science services use the radio spectrum for a range of applications, for example, observations of the natural environment made by sensors that function at frequencies set aside for the purpose. Earth exploration-satellites and the meteorological-satellite services are defined as science services, using passive or active sensors carried by satellites in Earth orbit. A special case is the radio astronomy service, which observes emissions of natural origin arriving from beyond the Earth's atmosphere. All radio astronomy allocations are used passively (i.e. there are no man-made transmissions involved).

There are three other science-related radio services. The meteorological aids service, which is used for links to platforms, airborne or seaborne, which gather meteorological data. The standard frequency and time signal service and the corresponding standard frequency and time signal-satellite service which is used for comparison of time and frequency standards and the dissemination of these standards.

²² Within this document reference to the Amateur Service should, unless indicated otherwise, be regarded as including the Amateur Satellite Service.

5.13.1. ComReg Strategy for Science Services

In general for the Science Services ComReg will:

- liaise with Met Éireann 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;
- remain apprised of possible means of reducing unwanted emissions to protect Radio astronomy, Frequency and Time Services and other passive services.

Regarding the Meteorological Services ComReg will:

- continue to offer a high degree of protection to the meteorological services, in view of their use in the safeguarding of human life and property;
- continue 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.
- ComReg will introduce a licensing regime for meteorological radars. A once-off licence fee of €500 for new stations or modifications to existing stations will be charged to cover co-ordination and notification costs.

Regarding Radio Astronomy, ComReg is aware of plans to establish a radio astronomy observatory in Ireland and will endeavour to protect such a site using internationally accepted procedures and techniques to mitigate and prevent interference in the frequency bands of interest.

5.14. Miscellaneous Services

5.14.1. Wireless Public Address Systems

ComReg intends to permit wireless public address systems the band 27.6 – 27.99 MHz to meet the needs of religious and other community organisations. This is intended to provide a public address system to facilitate the social inclusion of and meet the needs of the housebound be they sick, disabled and/or elderly, using wireless technology.

Following consultation with the Broadcasting Commission of Ireland (BCI), ComReg has established that the proposed service is not a broadcasting service and does not therefore fall under the BCI regulatory regime. This is reflected in four key characteristics which define wireless public address systems and place it outside the broadcasting space. These characteristics are:

- Spectrum will be allocated on a non-exclusive and non-interference basis in a frequency band not used by BCI Sound Broadcasting Contractors.
- The system is to be used for unabridged wireless retransmission of audio from a public address system that is associated with a public event.
- The service will only be available on a non commercial basis (for local community users).
- The service will not be available for reception on standard domestic broadcast receivers.

5

Strategy for Managing the Radio Spectrum and Specific Services Continued

Only equipment in the band 27.6 – 27.99 MHz that meets the requirements of the Radio and Telecommunications Terminal Equipment Directive (1999/5/EC) will be permitted for use on the available 35 channels within that band.

5.14.2. ECC Decision on Temporary Introduction of Automotive Short Range Radar²³ (SRR)

A recent CEPT ECC Decision opened the 24 GHz band for short range radar (SRR) in vehicles for anti-collision related applications on a non-interference, non-protected and temporary basis (until 30 June 2013 or sooner if the penetration of equipped vehicles in any European market reaches 7%).

In Ireland a process is underway to collect and report on the penetration vehicles fitted with 24 GHz SRR. This will be done via the vehicle registration process. The procedures which have been put in place at the European level will allow for regulators to stop the placing of 24 GHz SRR on the market if either the 7% penetration level is exceeded or undue interference is caused to other services, and in any case by 30 June 2013.

²³ ECC/DEC/[04]10 - ECC Decision of 12 November 2004 on the frequency bands to be designated for the temporary introduction of Automotive Short Range Radars (SRR).

6 Glossary

Term	Definition
3G	Third Generation
ADSL	Asymmetric Digital Subscriber Line
ATC	Air Traffic Control
BCI	Broadcasting Commission of Ireland
BSS	Broadcast-Satellite Service
CB	Citizens Band
CCDP	Co-channel dual polar, technique for combining horizontal and vertical polarisation to double capacity of a microwave fixed link
CDMA	Code Division Multiple Access, technique for differentiating between different spectrum users on the basis of unique codes rather than time or frequency
CENELEC	European Committee For Electrotechnical Standardization
CEPT	Conference of European Telecommunications and Postal Administrations
Consumer Surplus	The cumulative difference between the willingness to pay for a good and its price, used by economists to measure of the economic and other benefits of a resource such as the radio spectrum to consumers.
DAB	Digital Audio Broadcasting
DCMNR	Department of Communications, Marine and Natural Resources
DMB	Digital Multimedia Broadcasting
DSL	Digital Subscriber Line
DTT	Digital Terrestrial Television
DVB	Digital Video Broadcasting standard
DVB-C	Cable DVB standard
DVB-H	Hand-held DVB standard, intended for delivery of audiovisual content to handheld/mobile terminals
DVB-S	Satellite DVB standard
DVB-T	Terrestrial DVB standard
EC	European Commission
ECC	European Communications Committee
ECN	Electronic Communication Network
ECS	Electronic Communication Service
EESS	Earth Exploration-Satellite Service
EMC	Electromagnetic Compatibility
ERC	European Radiocommunications Committee (forerunner to ECC)
ETSI	European Telecommunications Standards Institute
FDD	Frequency Division Duplex, technique where two separate frequencies are used for forward and reverse transmission
FM	Frequency Modulation
FSS	Fixed-Satellite Service
FWA	Fixed Wireless Access
FWALA	Fixed Wireless Access, Local Area
FWPMA	Fixed Wireless Point to Multipoint Access
Galileo	Planned new European satellite navigation system

Term	Definition
GATT	General Agreement on Tariffs and Trade
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 GPSGlobal 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
HDFSS	High Density Fixed-Satellite Service
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)
ILS	Instrument Landing System
IMT-2000	International Mobile Telecommunications 2000 – A family of standards agreed by ITU for 3rd Generation mobile phones
ITU	International Telecommunications 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
MSS	Mobile-Satellite Service
NIR	Non-Ionising Radiation
NRA	National Regulatory Authority
PAMR	Public Access Mobile Radio, business radio service that provides services to third party subscribers
PMR	Private Mobile Radio
PMR 446	Licence exempt two way radio standard
Producer Surplus	The cumulative sum of the difference between the price of a good and what a firm is willing to be paid to produce the good, used by economists to measure of the economic and other benefits of a resource such as the radio spectrum to producers.
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
R&TTE	Radio and Telecommunications Terminals
Radar	Radiodetermination system based on the comparison of reference signals reflected, or transmitted from the position to be determined. This encompasses meteorological radars and radionavigation systems.

6

Glossary
Continued

Term	Definition
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.
RRC-06	2006 ITU Regional Radiocommunication Conference to address re-planning of broadcast bands for introduction of digital broadcasting
RTTT	Road Traffic Telemetry and Telematics
SAB	Services Ancillary to Broadcasting
SAP	Services Ancillary to Programme Making
SDR	Software Defined Radio
SI	Statutory Instrument
SME	Small and Medium Enterprises
SNG	Satellite news gathering
SRD	Short Range Device
SRR	Short Range Radar
TCAM	EU Telecommunications Conformity Assessment and Market Surveillance Committee
TDAB	Terrestrial Digital Audio Broadcasting
TDD	Time Division Duplex, technique whereby the same frequency can used for forward and reverse transmission
TES	Transportable Earth Station (satellite service)
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)
VoIP	Voice over Internet Protocol, technique for carrying real-time voice communication over packet data networks such as the internet
VSAT	Very Small Aperture Terminal (satellite earth station)
WBS	Wireless Broadband Services
WHO	World Health Organisation
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 access in bands above 3 GHz, also referred to as IEEE 802.16
WLAN	Wireless Local Area Network
WRC	World Radiocommunication Conference
WT Act	Wireless Telegraphy Act
WTO	World Trade Organisation

ANNEXES

SPECTRUM MANAGEMENT STRATEGY STATEMENT 2005 - 2007

Commission for
Communications Regulation

Annex 1

National Framework for Spectrum Management in Ireland

The main aspects of this framework are summarised in this Annex.

A1.1. Role of ComReg

In Ireland, ComReg is the National Regulatory Authority (NRA) responsible for the regulation of the electronic communications sector (telecommunications, radiocommunications and broadcasting²⁴ transmission). In carrying out its role in relation to radio spectrum management ComReg must:

- take into account 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
- have regard to international developments with regard to the radio frequency spectrum.

ComReg reports on its activities in respect of radio spectrum through public consultations and its annual reports.

A1.2. Summary of the Irish Legislative Framework for Spectrum Management

The Communications Regulation Act, 2002 (No. 20 of 2002) established the Commission for Communications Regulation (ComReg) and defined its functions and objects.

Until 2003, the WT Acts 1926-1988 provided the licensing framework for radio systems in Ireland. Under the WT Act 1926, an authorisation is required in order to keep and have apparatus for wireless telegraphy²⁵ and this authorisation generally takes the form of a licence or a licence exemption created under secondary legislation. ComReg has the authority to develop secondary legislation to permit the licensing or licence exemption of different types of wireless apparatus.

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 and the Broadcasting Act 2001. Irish television and radio broadcasters are licensed for the use of spectrum and apparatus under the Broadcasting Authority Act 1960 (in the case of RTÉ) and under the Radio and Television Act 1988 (in the case of the BCI contractors). MMDS and deflectors (which allow for the distribution of programme services in Ireland over the air in the 470 - 862 MHz band) are licensed by ComReg under the WT Act 1926. Broadcasting distribution and transmission systems are subject to the new EU regulatory framework for electronic communications networks and services.

²⁴ In relation to broadcasting ComReg's role is limited to spectrum management and assignment issues. Broadcast policy is decided by the Minister for Communications, Marine and Natural Resources and content issues are regulated by the BCI and the RTÉ Authority.

²⁵ Apparatus for wireless telegraphy is defined in the WT Act, 1926 (No. 45 of 1926) as "apparatus for sending and receiving or for sending only or for receiving only messages, spoken words, music, images, pictures, prints, or other communications, sounds, signs, or signals by wireless telegraphy and includes any part of such apparatus and any article primarily designed for use as part of such apparatus and not capable of being conveniently used for any other purpose".

In July 2003 a new regulatory framework for communications came into force. This had a significant impact on the manner in which the communications sector is regulated throughout Europe. The framework comprised 5 Directives²⁶ (Framework, Authorisation, Access, Universal Service and Data Protection) and one Decision (Spectrum Decision) and it aimed to promote competition, the interests of the citizen (universal service, consumer protection, privacy, dispute resolution) and the single European market.

The new framework regulations do not replace the WT Acts 1926-1988 but take priority over it. Since 2003, licensing of wireless electronic communications services and networks under the WT Acts must be done in accordance with the requirements of the framework regulations.

In the next 2 to 5 years it is expected that a number of new Bills relating to the regulation of the electronic communications sector will be enacted. These include a new Telecommunications (Miscellaneous Provisions) Act, a new Radiocommunications Act, which will replace the Wireless Telegraphy Acts 1926-1988, and a new Broadcasting Act. The implications of this new legislation will be included in future strategy documents.

²⁶ Available at http://europa.eu.int/information_society/topics/telecoms/regulatory/new_rf/

Annex 2 Summary of the Economic and Social Impact of Radio Spectrum Use

A2.1. Introduction

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. Research carried out on ComReg's behalf by Aegis Systems and Indepen Consulting, based on publicly available data, concluded that the total contribution to Irish GDP arising from the use of radio spectrum in 2003 was nearly €2 Billion, or approximately 1.4% of total GDP. A conservative estimate of the number of employees in Ireland whose jobs are dependent on the use of radio spectrum was over 24,000²⁷.

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, whilst radio plays a major role in enabling the Irish Defence Forces to carry out their duties both at home and overseas. Radio is fundamental to the safe operation of air, sea and land transport and Ireland plays a particularly important role in managing international radio traffic in the aeronautical sector, dealing with over 70% of all transatlantic flights. It is therefore clear that the contributions of the defence, public safety and transport sectors to society and the economy is heavily dependent on access to radio spectrum.

Two different approaches to measuring the economic contribution of radio communication were used in the Aegis / Indepen study. The first approach involves measuring the contribution to Irish Gross Domestic Product (GDP) and employment associated with radio using services, while the second involves estimating the benefit consumers and producers derive, termed consumer surplus and producer surplus respectively, from radio based services. In both cases data limitations mean that the most robust estimates are obtained for public cellular (mobile) and broadcasting services and only partial estimates are possible for other services.

A2.2. GDP and Employment Contribution

The following table shows the estimated contribution to GDP and employment for each of the main uses of radio spectrum. Data for maritime services has not been included as it is not possible to determine 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).

The approach taken to determining 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, which 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 and for broadcasting services included revenue generated through forward links to the advertising industry. Full details of the methodology used for each service and the figures in each category are contained in ComReg Documents 05/01 and 05/36. 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 the table below.

²⁷ These estimates are likely to understate the total contribution as it was not possible to value all services, because of lack of suitable data.

The employment effects were estimated directly where suitable data was available, for example from annual reports and where this was not possible the average estimates of value added per employee were obtained from industry statistics (Central Statistics Office) and used to obtain figures for employment levels. The figures for broadcasting include contributions from the broadcast advertising industry, TV and radio.

	GDP (€m)		Employment	
	2002	2003	2002	2003
Mobile	569	834	8551	7928
Broadcasting	208	265	4310	4331
Fixed links ²⁸	1	1	20	20
Air services	498	600	11988	11829
Short range devices	230	230	581	581
Other services	14	14	330	330
Total	1520	1944	25780	25019
% of total economy	1.1	1.4	1.4	1.4

Table A2.1: Summary of GDP and employment impacts

In addition, estimates of consumer and producer surplus have been produced for some services and these are summarised in Table A2.2 below. Again the estimates are partial but they indicate there is very substantial benefit to consumers and industry from use of the radio spectrum. Note that the consumer surplus figures may underestimate the benefits of TV broadcasting since they do not take account of terrestrial TV services originating outside Ireland. Similarly, the GDP contribution from the mobile sector is likely to be understated as this does not include certain indirect contributions, such as the distribution of mobile phones or additional services that might be facilitated by mobile communications.

Service	Consumer and producer surplus (€m)
Mobile	1625
Broadcasting	290
Fixed links and satellite	645
Business radio	56

Table A2.2: Summary of GDP and employment impacts

²⁸ 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.

Annex 2

Summary of the Economic and Social Impact of Radio Spectrum Use

Continued

A2.3. Consumer and Producer Surplus

The economic concept of welfare can be used to capture the economic and other benefits of a resource such as the radio spectrum. Welfare can be measured as the total 'surplus' associated with the allocation of scarce resources and is made up of consumer and producer surplus. Consumer surplus is the cumulative difference between the willingness to pay for a good and its price. Producer surplus is the cumulative sum of the difference between the price of a good and what a firm is willing to be paid to produce the good i.e. 'supernormal profit'.

In the case of the mobile and the broadcasting sector the estimates of consumer surplus were based on existing UK and Irish willingness to pay studies for the uses of spectrum. The UK studies were used to generate ball park estimates of consumer surplus under certain assumptions, for example that the benefits that consumers enjoy from the services and the nature of the services are very similar. The producer surplus for mobile services was calculated by looking at the rate of return on capital employed in the mobile business, as estimated in the ComReg market analysis paper on mobile access and call origination and the average of the reported rate of return on capital set by regulators in Europe.

In the case of fixed services and VSAT satellite services the efficiency benefit (i.e. cost reductions) of the use of these services as compared with the use of alternative technology or services, such as leased lines was used to provide an analogous measure to consumer surplus.

ComReg considers that the efficient management of spectrum contributes to economic growth by supporting the development of knowledge based services and attracting foreign investment; promoting competition in communications services, promoting the competitive provision of radio based equipment and by supporting the development of new and innovative services in a timely manner.

Efficient use of radio spectrum also benefits the economy through the additional economic activity associated with use of the resource and the efficiencies that use of radio technology enables. For example, mobile phone companies and companies that provide software and other services to the mobile phone industry would not exist without access to radio spectrum. This is not to say that all of the output and employment associated with these sectors would be lost if the radio spectrum they use was not available because in these circumstances consumers would make expenditures on other goods and services. However, costs to business would be increased, as they would have to use less efficient forms of communication and this in turn would have a negative impact on consumer wellbeing as they spend more on less convenient goods and services.

Annex 3 The Role of Spectrum Management

Management of the radio spectrum is the combination of administrative, regulatory and technical procedures necessary to ensure the efficient operation of radiocommunication equipment and services. Simply stated, spectrum management is the overall process of regulating and administering use of the radio frequency spectrum. A primary goal of spectrum management is to ensure optimal use of the radio spectrum, in social, economic and technical terms.

In managing the radio spectrum, regulators must weigh up all competing factors to ensure the optimal use of all frequency bands. These factors include:

- ensuring that we meet the requirements of all radio services and that there is a balance between the 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 uses 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. Clearly, 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.

Public policy goals play a significant role in determining spectrum management policies. 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 sometimes be constrained by international obligations related to spectrum use.

ComReg's role as a spectrum manager is to ensure as far as possible the optimal use of spectrum resources, within the constraints set by national and international legislation and regulations, technology considerations and national public policy objectives. ComReg's spectrum management activities embraces four main areas namely frequency allocation, the regulatory framework, frequency assignment and enforcement. 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. ComReg plays an active role, along with DCMNR, 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.

Access to the spectrum is granted by ComReg assigning frequencies for use by a service, either to individual users by issuing individual rights to spectrum use or by general authorisation (licence exemption) as is the case for many short range device applications, for example Wi-Fi. Where demand for the available spectrum exceeds supply a comparative selection process is used to determine which entities will be granted spectrum rights of use.

Frequency assignment and enforcement activities govern how individual users may access radio spectrum and ensure that legal and technical conditions are complied with, in order to avoid interference. Frequency assignment includes the processing of licence applications and the issue and renewal of licence documents. Enforcement includes monitoring the spectrum to ensure that use is in accordance with licence conditions, and taking legal action where the conditions

Annex 3 The Role of Spectrum Management

Continued

are infringed. The resources available to ComReg to carry out its spectrum management role include technical and administrative staff, technical planning tools and databases containing information on licences and spectrum use. Together these resources enable ComReg to manage the use of radio spectrum in a way that maximises the benefit to individual users and the country as a whole.

Figures A3.1 and A3.2 below illustrate how the spectrum is apportioned between different services in the bands above and below 3,000 MHz. It can be seen that most of the spectrum below 3,000 MHz is used for broadcast, mobile and aeronautical applications, reflecting the long transmission range and non-line of sight reception capability at these frequencies, whereas the higher frequencies are predominantly used by fixed terrestrial and satellite services.

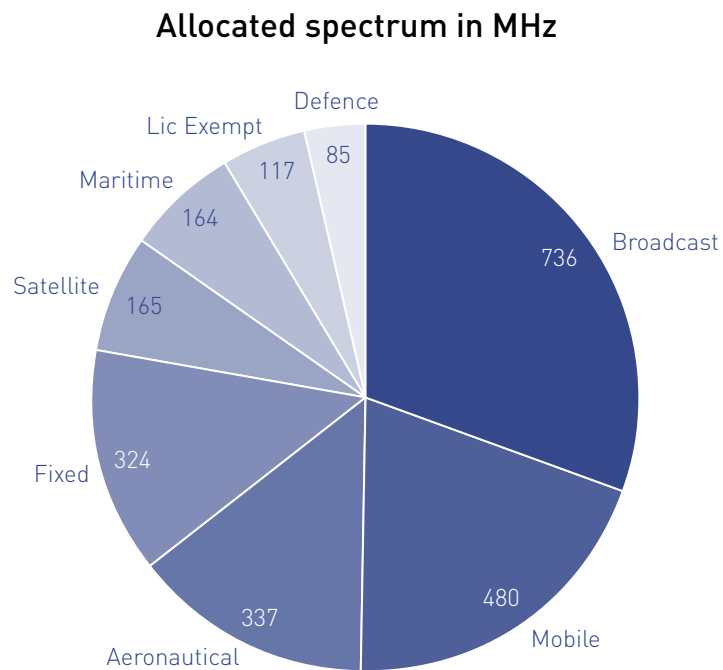


Figure A3.1: Principal spectrum allocations in Ireland in the VHF & UHF range (30 MHz to 3000 MHz)

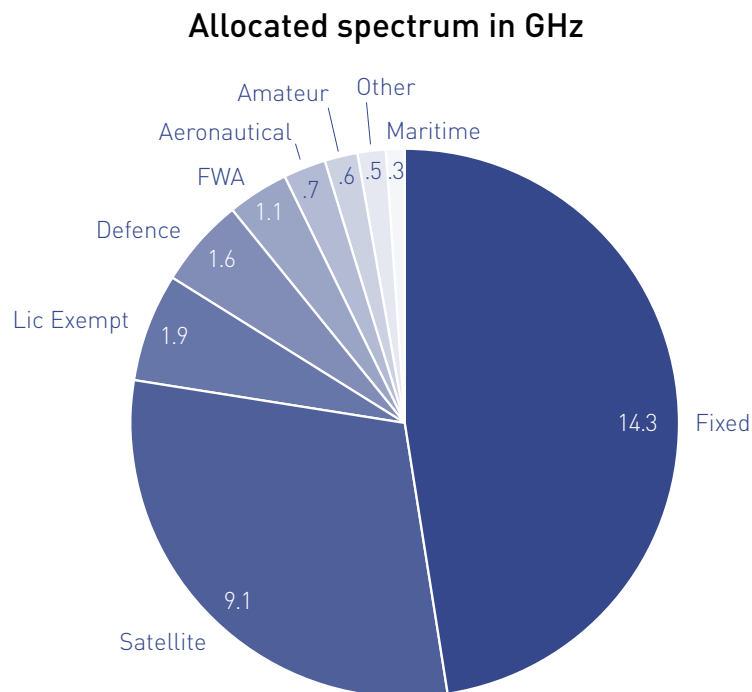


Figure A3.2: Principal spectrum allocations in Ireland in the microwave range (3000 MHz to 30 GHz)

Figure A3.3 illustrates the breakdown of individual licences issued by ComReg. It can be seen that three categories account for the majority of licences issued, namely fixed links, ships radio and business radio. Fixed links are used extensively to support the roll-out of mobile phone networks for example and are individually licensed by ComReg. Ships and business radio licences are held by many individuals and companies in Ireland, whereas other licence categories are relatively specialised and issued in correspondingly smaller quantities.

Annex 3 The Role of Spectrum Management

Continued

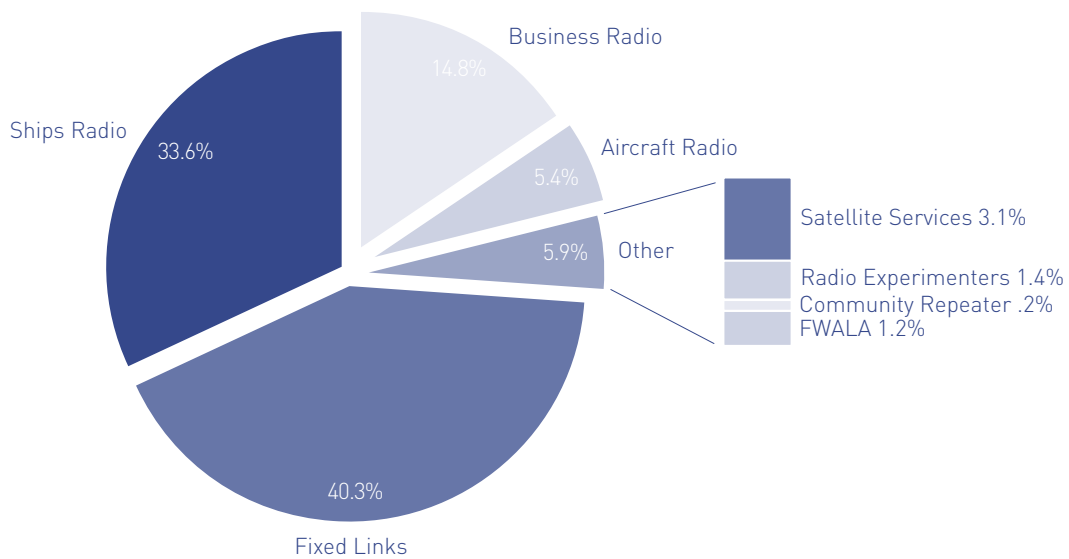


Figure A3.3: Breakdown of the total volume of licenses issued in the three year period from May 2002 to May 2005.

Figure A3.4 presents details on the number of live radio licences per year from 2000. Live radio licences is the difference between the number of licences issued and the number of licences cancelled. This gives a better picture of the increase or decrease of holders of licences. In some cases, for example in the satellite licensing area, the decrease is due to the licence exempting of a number of services.

Number of Live Radio Licences '00 to '05

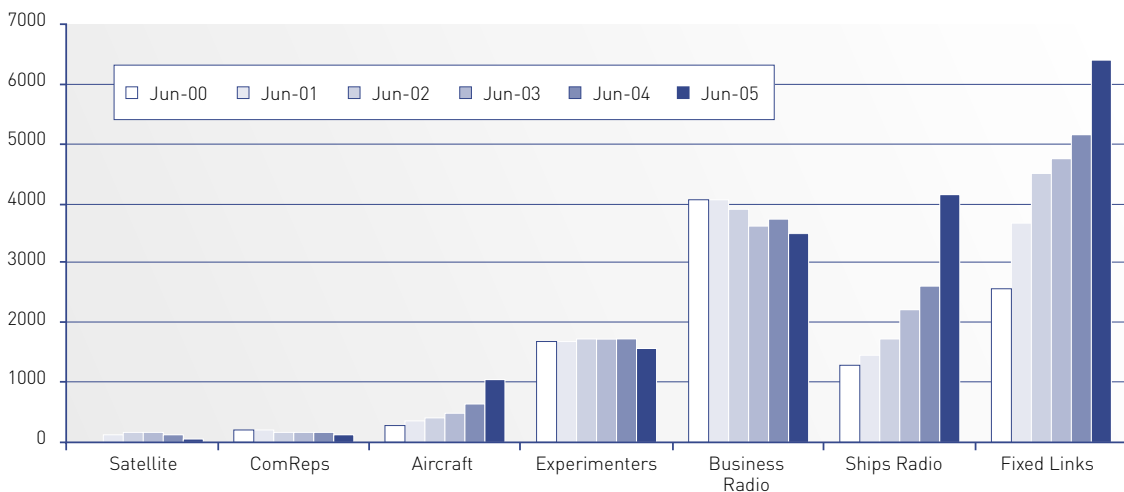


Figure A3.4. Breakdown of the total number of active licenses issued - 2000 to 2005.

Annex 4 Planning for the Future: Two Scenarios for Wireless Market Evolution

A4.1. Introduction

The strategy described in Chapter 5 has been developed in response to the spectrum demand drivers discussed in Chapter 4, based on assumptions about how these drivers will impact on spectrum demand in the future. The strategy is intended to cover the next two years (i.e. the period up to the next revision of this strategy document), however the effect of the strategy will extend well beyond that period, since it will set the framework in which business decisions are made concerning future product or service innovations. It is important that the strategy is sufficiently robust to accommodate anticipated developments in the market and minimise uncertainty for market players, whilst retaining the flexibility to cope with a range of possible future market scenarios.

In order to test the effectiveness of its proposed strategy, ComReg has undertaken a scenario planning exercise, in which two distinct future scenarios for the electronic communications market were considered. One scenario assumed rapid and substantial growth in the market for mobile, broadcast and broadband services along with a high degree of convergence, while the other assumed a more gradual evolution of the market. In each case, the implications for spectrum demand were considered. It was clear from the analysis that the greatest implications for spectrum demand arose in the high growth scenario and ComReg has therefore developed this scenario further in the light of responses received to the consultation.

The following sections provide a background to the scenario planning process and describe the high growth scenario that ComReg has developed. By focusing on this high demand growth scenario, ComReg will ensure that its spectrum strategy has the flexibility and responsiveness to cope with significant changes in demand for spectrum should these arise.

A4.2. Background to Scenario Planning

Forecasting the future demand for wireless services and content in a highly dynamic market is not straightforward. Innovations in technology, service delivery and pricing can have a major impact on the take-up of wireless services. For example, the introduction of relatively low cost subsidised pre-pay mobile phones has driven mobile phone penetration to levels far exceeding analysts' predictions of a decade ago. Similar growth in demand for mobile broadband services and content could have significant implications for future demand for radio spectrum to support these services.

In an attempt to assess what the implications of such demand growth might be, ComReg has used a scenario planning approach, under which two contrasting scenarios were developed representing different degrees of demand growth for radio services and the implications for spectrum demand considered. Scenarios in this context are specially developed stories about possible futures, each one modelling a distinct, plausible world in which we might someday have to live and work. Scenario planning is the process of developing such scenarios and consequentially preparing strategies and plans that allow an organisation to act proactively in the event of particular scenarios unfolding.

The two draft scenarios described below represent plausible futures driven by trends and other factors we can see developing today and take account of future uncertainties. This grounds the scenarios in reality whilst providing scope for exploration of potential change and uncertainty.

Annex 4 Planning for the Future: Two Scenarios for Wireless Market Evolution Continued

A4.3. Two Alternative Scenarios for Ireland – Wireless Boom or Steady Growth

To guide our long-term planning we developed and consulted on two possible scenarios for the future state of radiocommunications services in Ireland, over a ten year timescale. The first scenario, “wireless boom”, envisaged a rapid expansion in the market for wireless communication across all sectors, building on the historic growth already evident in the mobile sector, whereas the second scenario, “steady growth” envisaged a more gradual evolution of the market. The first scenario implied major changes in the way spectrum would be used to deliver services, driven by market and technological developments, whereas the second scenario implied a more gradual and ad-hoc approach to accommodate a limited range of new services. Both of the scenarios were based on a view of the sector in December 2004.

In the tables of assumptions presented under each scenario, the likelihood of the assumption arising is based on responses received to consultation document 05/01 and the impact reflects ComReg’s own assessment of the how significantly the assumption might affect future spectrum demand for the service concerned.

A4.3.1. “Wireless Boom” Scenario

This is a future of ubiquitous availability and widespread use of wireless based services, including fixed, mobile and broadcast applications as well as convergent services that combine attributes of two or all three of these. In this scenario, most consumer segments are avid users of mobile services and welcome the boost to broadband access that FWA and WLANs have provided. The business sector continues to push the boundaries of wireless usage through mobile, FWA, WLANs, as well as segment specific services such as PMR and PAMR. Businesses report increased productivity gains as employees have access to wireless based services that allow them to work more effectively and seamlessly, wherever they are.

Wireless technology provides all the benefits previously considered only achievable from fixed technologies, notably very high speed data transfers of hundreds of MBit/s. Fixed and mobile services work well together, with earlier interoperability issues sorted out. A wide range of audiovisual content is available, both in real-time broadcast format and on-demand, and accessible via a range of platforms including fixed display devices (e.g. TV) and portable display devices (e.g. PDAs and mobile phones).

Assumptions for Wireless Boom Scenario

Ref	Assumption	Likelihood	Impact
i	3G mobile becomes firmly established, with market penetration approaching the current levels of 2G services and widespread downloading of rich mobile content such as high-quality audio and video.	Medium	High
ii	Continuing growth in the transport and logistics sectors maintains demand for PMR and PAMR services, dedicated to particular user groups, including new digital and data-oriented services using wideband technologies.	High	Medium

Ref	Assumption	Likelihood	Impact
iii	Ubiquitous availability of digital multi-channel TV by cable/MMDS and satellite enables analogue transmissions to cease. Digital terrestrial transmission primarily focuses on mobile TV and other content, and on supporting broadband access in rural areas.	Medium	High
iv	Mobile digital TV and delivery of audio visual content to mobile phones is commonplace, using the DVB-H standard.	Medium	High
v	There is very high demand for broadband access throughout the country, which can be met only by radio in some areas due to remaining deficiencies in legacy wireline networks. Much of the demand growth is on-demand video content which drives bandwidth and quality of service requirements further, leading to pressure for more FWA spectrum in the 26 GHz and 40 GHz band.	High	High
		Medium	High
vi	There is extensive availability of free "community" WLAN services, placing pressure on available spectrum and driving demand for more spectrum including licence-exempt spectrum.	High	Medium
vii	DAB has been launched and has achieved a substantial market penetration. L-band (1452 – 1492 MHz) DAB spectrum has been licensed for a mix of audio and multimedia services.	Medium	Medium
viii	Regional wideband PAMR services have been established to cater for specialist users.	Low	Medium
ix	Backbone radio links have largely been superseded by extensive fibre infrastructure. However there is continuing growth in demand for access and infrastructure links in higher frequency bands (above 12 GHz).	High	Low
		High	Medium

A4.3.2. "Steady Growth" Scenario

This is a future of cautious optimism as society tests wireless based services and slowly acknowledges their potential benefits. End users have become relatively cautious in their adoption of wireless-based services as initial services could not meet their full expectations and as a result will not readily adopt new unproven services. In this scenario many end users hold out for the promise of better services and technologies to come, which provides a high level of inertia.

Although broadband availability has improved considerably, adoption continues at a steady pace rather than exponentially. Wireless-based services are seen as totally separate to other fixed services and interoperability between wireless and fixed services is problematic.

Annex 4 Planning for the Future: Two Scenarios for Wireless Market Evolution Continued

Assumptions for Steady Growth Scenario

Ref	Assumption	Likelihood	Impact
i	Widespread availability of broadband in non-rural areas, backed in part by government initiatives, involving extensive use of FWA technology. But take up of broadband in the market is limited and data speeds are no higher than today, so demand for spectrum has not gone beyond the currently available bands.	Low	Low
ii	Mobile data remains a niche market, 3G coverage restricted to main urban areas, no immediate demand for more spectrum.	Medium	Low
iii	Mobiles are still predominantly used for voice and messaging services, with limited demand for data, so there is no immediate requirement for any spectrum beyond the current 2G and 3G allocations.	Medium	Low
iv	There is only limited use of WLANs in homes and businesses and the existing 2.4 GHz and 5 GHz are sufficient to meet this demand. There is also only limited demand for public WLAN connections.	Low	Low
v	Continuing popularity of 2nd generation mobile technologies and analogue broadcasting constrains scope for new services in these bands and increased pressure on other available spectrum such as the 410-430 MHz band.	High	High
vi	Continuing reliance on radio for backbone networks has led to congestion in some frequency bands.	High	High
vii	Limited availability of terrestrial broadband access networks in rural areas has created demand growth for satellite based broadband access, both for individual users and to provide hubs for local communities who connect using WLAN connections	Low	Low

A4.4. ComReg Wireless Vision for 2010

A4.4.1. Introduction

Based on the responses to consultation document 05/01 and ComReg’s assessment of the impact specific developments might have on future spectrum demand, a more detailed future scenario for the potential wireless market in 2015 has been developed. This scenario is intended to represent a plausible vision of a future where a substantial increase in spectrum demand would arise. A key element of ComReg’s spectrum strategy will be to provide, as far as practicable, the flexibility to accommodate such demand should it arise. The scenario will be reviewed on an ongoing basis in consultation with industry and consumer groups

A4.4.2. Scenario Overview

The scenario underpinning ComReg's Wireless Vision for 2010 is characterised by a strong 'feel good factor' permeating society, not dissimilar to the late 1990s run up to the new Millennium. The Irish economy is very stable with strong growth based largely on the actions of people exhibiting highly individualistic characteristics. Technology is now really empowering both individuals and businesses and is highly trusted to deliver the required levels customisation and interaction demanded. Consequently, people quickly embrace the opportunities of new technologies.

Overall the scenario is one that is highly socially inclusive, upbeat and optimistic with high levels of pervasive, integrated technology supporting strong uptake of new communications services and applications, including wireless. The scenario envisages ubiquitous availability and widespread use of wireless based services, including fixed, mobile and broadcast applications as well as convergent services that combine attributes of two or all three of these. In this scenario, most consumer segments are avid users of mobile services and welcome the boost to broadband access that FWA and WLANs have provided. The business sector continues to push the boundaries of wireless usage through mobile, FWA, WLANs, as well as segment specific services such as PMR and PAMR. Businesses report increased productivity gains as employees have access to wireless based services that allow them to work more effectively and seamlessly, wherever they are.

Wireless technology provides all the benefits previously considered only achievable from fixed technologies, notably very high speed data transfers of hundreds of MBit/s. Fixed and mobile services work well together, with earlier interoperability issues sorted out. A wide range of audiovisual content is available, both in real-time broadcast format and on-demand, and accessible via a range of platforms including TVs, PCs, PDAs and mobile phones.

A4.4.3. Key Characteristics of the Scenario

ComReg's 2010 Wireless Vision is characterised by:

- highly stable economy with continuing strong growth of GDP at 5% pa;
- growing contribution to economy from telecoms and IT expenditure;
- customers very individualistic and fully embracing opportunities of new communications technology to support their lifestyles;
- cyber crime has reduced following concerted efforts to improve security and safety;
- the majority of businesses online, most with broadband connections and with universal acceptance of the importance of e-commerce and increasingly m-commerce;
- broadband, Internet and 3G mobile are all pervasive technologies interworking to a high degree;
- terrestrial digital TV has been launched and achieved 30% penetration;
- there is room for many players to exist in buoyant market and no major consolidations have occurred. Fourth 3G licence has been awarded and 3G market penetration is now over 80%;
- Niche public wireless networks cater for certain user groups (e.g. transport / logistics), alongside rising PMR and PAMR use which remains around 20% below current (2004) levels;
- broadband penetration has reached 80% of households, a quarter of these are served by some form of wireless connection;
- Over 60% of homes now use wireless local area networks to connect computers and/or multimedia entertainment devices;
- market forces dominate and there is little need for high levels of regulation;

Annex 4 Planning for the Future: Two Scenarios for Wireless Market Evolution Continued

A4.4.4. Socio Economic Conditions

Ireland has emerged from the start of the 21st century as a prosperous, optimistic, well-educated economy and continues on a long-term upward trend. The economy is very stable with strong GDP growth of around 5% pa. Telecoms expenditure is a strong component of the Irish economy with telecoms end user expenditure amounting to over 5% of GDP. People are now much more likely to embrace new services and associated technologies and are willing to try out different options and to create their own combinations of services and applications. People now have a higher recognition of the benefits that technology brings to enhance their quality of life.

Ireland has developed a pattern of diverse working policies to suit and support individuals such as flexible, part-time working and home working. The more flexible workforce also has a broad and deep skills base as competition pushes the need for highly qualified specialist professional, often with skills in more than one discipline. Wi-Fi connectivity is routinely available on public transport services enabling commuters to access their office networks on the move.

Market operation is efficient with relatively short cycles and low levels of waste. Profit levels are maintained at levels which reflect the highly competitive nature of the industry and yet provide real incentives for further investment and market entry. Free market forces dominate and markets are highly competitive with players providing high levels of choice demanded by customers.

A4.4.5. Market Requirements

By 2010, markets are dominated by:

- strong groups of individuals who have a clear understanding of their needs and can translate that into very specific product and service requirements for their providers;
- businesses that have developed clear communications requirements and tend to test and evaluate new services to determine the best ones to support their operations.

Consequently, technology and service adoption is much faster across all markets including consumers, SMEs and large enterprises and a high proportion of services survive product launch and enter mainstream adoption. Buying and selling over the Web has become a way of life for businesses and consumers as they see the benefits of being able to put together individualised packages of products and services very easily in addition to the convenience of making transactions anytime, any place. However, as elsewhere, this has led to an increasing level of disintermediation.

A4.4.6. Consumers

Consumers form the most important customer group in the scenario by virtue of being the largest and most diverse group, driving the individualism in the economy. On the whole, consumers readily embrace the opportunities of technology and are becoming confident enough to pull together their own individual solutions from different technology and service components if necessary. They are willing to try new products and services and will trade up to the next best thing they think matches their needs.

People value their personal time and their individual diversity and enjoy higher levels of disposable income of which communications services and applications are taking a higher proportion. Disposable time is consumed across a wider range of activities which means individuals want much more personal control over how they use their time and want more mobile communications services and content to support their lives. There is now high usage of time-shifting products and services, such as personal digital video recorders and messaging, in response to need for more control and management of personal time. By 2005 most individuals began to use some form of time shifting product to manage their professional and personal lives.

Consumers readily buy goods and services online (increasingly using mobile terminals) as it allows them to shop around easily and make individual choices about the packages of services they need.

Users are very demanding of media and content providers to deliver highly interactive content and programming which users can customise to their individual requirements. They do not want standardised packages or bundles and look to providers to deliver ways of personalising services or content. They look for more mobile content and interaction with content whilst "away from base".

Consumers' key communications requirements centre around:

- personalisation of services to support lifestyle choices;
- mobility and the ability to access applications, services and content over a variety of devices and channels;
- secure high speed online access to goods and services from the home and elsewhere;
- applications and products for the management and control of disposable time;
- personal entertainment and support for finding and delivering digital content.

A4.4.7. Businesses

Businesses have high need for online services to serve consumers and other businesses most of whom are interacting via e-transactions. The majority of companies have websites set up for e-commerce. Over 85% of all businesses are buying goods and services online and over 80% are selling online.

Businesses have responded to the pressure from their employees for more flexibility in the workplace as people have become far more individual in their lifestyles. High levels of flexible working are achieved as individuals seek ultimate control over the balance between work, family and personal life. Visionary companies embrace this and support employees by providing the corresponding environment to allow remote working, including time-shifting working lives, pushing up reliance on broadband and mobile services.

A4.4.8. SMEs

SMEs continue to grow in number as they seek opportunities from the growth in niche markets. They are a strong influence in the economy not only because of the sheer number of SMEs but also because they can operate with almost the same advantages as larger enterprises brought about by high levels of adoption of broadband enabled online services giving them the reach and presence in the niche markets.

Annex 4 Planning for the Future: Two Scenarios for Wireless Market Evolution Continued

SMEs' key communications requirements are for:

- high degrees of access to online customer databases;
- automation to provide cost advantages in front and back office operations;
- secure transactions to ensure trusted and reliable online commerce;
- secure networks to allow flexibility and access for remote working of employees;
- application and data interworking and sharing to allow SMEs to put together virtual value chains with other players targeting new market niches.

A4.4.9. Large Enterprises / Multinational Corporations (MNCs)

Large enterprises and MNCs represent a large market in terms of value of communications expenditure. Large enterprises embrace most technology advances in the belief that they will provide enhanced competitive advantage, e.g. in terms of speed to market or better market intelligence. Their communications requirements are for:

- pervasive high speed broadband and mobile access for employees;
- secure, integrated voice and data networking solutions providing national and international hub and spoke connectivity;
- high availability (at least 99.999%) for data integrity and security;
- management and communication for remote and mobile employees;
- service pricing related to speed, availability and reliability.

A4.5. Key Communications Technologies and Services

A4.5.1. Overview

The Irish technology base has become highly innovative and diverse. It has become much more user-focused, providing customer-led applications and services, which deliver their promise and reflect individuals' needs for security and protection. Ubiquity of demand has forced technologies to be highly pervasive covering geography and population. This has resulted, over the decade, in the development of a highly integrated communications infrastructure combining the delivery elements of fixed, mobile and broadcast communications.

There are high levels of R&D driving the next waves of innovation. Time to market has reduced, as have pay back periods for successful products as users are much more accepting of technology and have high propensity to try out and adopt the next innovation. There is now greater co-operation between network operators for interoperability – this is more than just interconnect and includes re-purposing of content, mediation, and use of shared network databases as well as roaming requirements across different networks.

A4.5.2. Broadband

High levels of broadband connectivity are required driven by increasing consumer and business demand. Individuals and SMEs readily adopt broadband with high levels of broadband demand and usage driven by high levels of availability of content and applications such as video streaming. Narrowband demand tails off rapidly over the period. Consumers have

a wide choice of quality broadband content which is easily customisable to suit individual requirements. Also, consumer triple-play (telephony, TV & Internet) services are now enjoying a wide appeal and compete strongly with cable offerings. This further drives DSL growth in the market and consumer broadband is now nearing saturation. There is high demand for broadband access by SMEs and most (over 80%) now use broadband as part of an integrated applications and content packages, often with bundled offerings including Internet access, e-mail, firewall and hosting services. ADSL has become the main access method used by teleworkers in SMEs and larger enterprises where DSL becomes an important access method for secure VPNs. Limitations of the legacy cable and fixed line infrastructure has led to fixed wireless networks gaining a 25% share of the domestic broadband market. Business demand for high speed communication links has driven demand for wireless services operating in higher frequency bands (26 GHz and more recently 40 GHz) that can delivery bit rates of up to 155 Mbit/s or more.

Certain rural areas remain unserved by broadband and there is pressure to release some of the UHF TV channels for rural wireless services, based on the IEEE 802.22 standard which has been widely deployed in the US.

A4.5.3. 3G Mobile

Both fixed and wireless technologies co-exist with no one technology claiming dominance as they are both demanded by users to deliver required service ubiquity. 3G mobility is a complement to fixed broadband. As such, 3G mobile is now a highly successful pervasive technology and is in a period of high growth with cheaper handsets, good levels of service support together with a broad range of personalised applications.

Mobile communications services are concentrated on voice, text and multi-media messaging and location or context-based information services are also very important. Customers have rapidly increased the amount of mobile data usage as they increasingly prefer to download content, exchange messages and engage in mobile commerce anywhere. Mobile data revenues have achieved penetration of 35% of total mobile revenues. M-commerce applications account for around 3.5% of mobile data revenues.

Audio and visual content now widely available to mobile devices and there is growing demand for access to spectrum in the TV broadcast band to support low cost content distribution (mobile phones with built in digital TV receivers have been available in Europe for several years).

All phones are now equipped with multimedia messaging capability. Individuals continue to grow usage of person to person messaging (including text messaging and increasingly photos and video). In addition, people readily adopt new forms of content messaging (machine to person) as they find benefit from information delivery to the handset any place, anytime in a way that they can personally configure.

Messaging usage rates and growth are very high as people enjoy the benefits of multimedia interaction on Peer to Peer as well as content delivery.

Plans are being developed for 4G introduced as an evolutionary step from 3G. Standards are by now well-developed and technologies have been agreed by the main players. Growing capacity demand increases pressure to release all of the 2.6 GHz band for mobile applications.

Annex 4 Planning for the Future: Two Scenarios for Wireless Market Evolution Continued

A4.5.4. WLANs

Wireless LANs are commonplace as businesses quickly recognised the benefits of wireless technology. There is a relatively high penetration of WLANs with consumers as they see the benefits of untethered access to their services and applications in the home. Wireless 'freenets' based on Wi-Fi are well established, driven by community-minded individuals and security has improved since the early days, however these are increasingly supplanted by commercial offerings.

Public wireless LAN hotspots are very successful and commonly available in all major cities especially airports, libraries, branded chains of coffee shops, shopping centres, business parks and motorway service areas. The main users are business travellers, mobile 'road warriors' and the many high-end technically literate consumers who also use WLANs at home. Towards the end of the period, mesh radio and ultra wideband are starting to become potential substitute technologies.

A4.5.5. Internet

Narrowband Internet access has been almost entirely replaced by broadband access. Buying and selling over the Web becomes a way of life for businesses and consumers as they see the benefits of being able to put together individualised packages of products and services very easily in addition to the convenience of making transactions anytime, any place. Nearly all businesses have implemented websites with mission-critical capabilities as they see the benefits in relying on the now proven technologies, in the knowledge that consumers and other businesses have fully embraced the web era – indeed see it as the priority way of interacting.

A4.5.6. Digital TV

Terrestrial digital TV has been launched and achieved 30% penetration; with cable and satellite over 90% of homes now have digital TV. Analogue scheduled for switch-off by 2014. It has fulfilled its promise of providing personalised interaction allowing users to select and effectively manage their own programming. This is now important as there are high levels of cultural and regional diversity. Households and individuals have taken up multiple subscriptions for different family members as strength of individual choice and control is always high. Apart from live events, there is much less synchronised or simultaneous viewing. People are now watching broadcast programmes at a time that suits them.

A4.5.7. Devices

The convergence between computers, mobile phones and consumer electronics doesn't happen as anticipated and there is not one ubiquitous device that does everything. Specialist devices win the battle over multi-purpose devices. Users know exactly what they want from a product and how they want to use it. They are not satisfied with what they perceive to be sub-optimal 'generalist' devices and products. There are now more wearable devices and more connected (online) machines.

Vendors push the limits of technical development and design to introduce the 'next best' device packed with features and functionality. Specialist devices have become technically easier to build with component manufacturers having refined the art of integration resulting in the ability for simple cellular modules on a single chip which makes specialised devices much cheaper to produce. Customers seek out devices that will satisfy specific needs and are happy to have the necessary 'gadgets' for different jobs and applications as they have found from experience that separate devices do not compromise performance in the way that multi-purpose devices can do.

Early 3G handsets had a few teething problems but quickly these are overcome and they prove to be just as reliable as 2G handsets. Battery technology continued to improve to deliver high power and charge capacity to weight ratios. Nearly all individuals are satisfied that using mobile phones is safe, with little or no risk to health and any risks are far outweighed by the benefits.

Feature phones are continuing to sell very well and overtake sales of voice phones in 2005 as the content market opens up allowing individuals to gain easy access to games, music, video clips, etc. Multimedia feature phones also start to become more popular spurred on by developments such as video messaging functionality and the inclusion of digital broadcast receivers.

Vendors realise that users who want both PDA and feature phone capabilities would rather keep them separate in the same way that most consumers still buy their television and video recorders separately. Some individuals will have a core device (e.g. a good feature phone) and a number of other accessory devices which may be temporary or disposable.

Whilst devices are highly specialised, delivery platforms have become more standardised and integrated in order to provide the mechanisms for transporting to the plethora of devices. As such, applications and content are essentially platform independent, reliant on highly customised software which can be downloaded. The development of open standards and web services in particular has supported this platform independence. Multi-channel delivery has become the norm as users decide how they want to receive and access their content and applications; there is extensive re-purposing of content for multiple display devices.

A4.5.8. Service Portals and Digital Content Delivery

All portals are now highly personalised with multichannel access. Context management is now a key feature of portal applications, providing user interface and delivery of content according to the users' access device. Most users are now accessing content over mobile. Multi-channel delivery is now the norm and users have access to the same core content and services irrespective of the devices they use. Their preference is for a single relationship with their content and service provider rather than needing to have separate relationships and contracts according to the services they want. This drives major brand players to develop highly accessible multi-channel portals.

A4.5.9. Digital Audio / Multimedia Broadcasting

After a slow start DAB has made inroads on the strength of added value content and services (e.g. audio / video downloads and new specialist radio channels). Around 30% of homes now have a DAB receiver and an increasing number of mobile phones have DAB / DMB functionality. The latter have prompted the launch of L-band services that have been overlaid on the existing cellular networks.

A4.6. Implications for Spectrum Demand

- **Mobile:** Widespread demand for high speed mobile data means existing 2G and 3G spectrum is fully utilised and pressure is growing for access to other bands such as the 2.6 GHz band which is still being used by MMDS services.

Annex 4 Planning for the Future: Two Scenarios for Wireless Market Evolution Continued

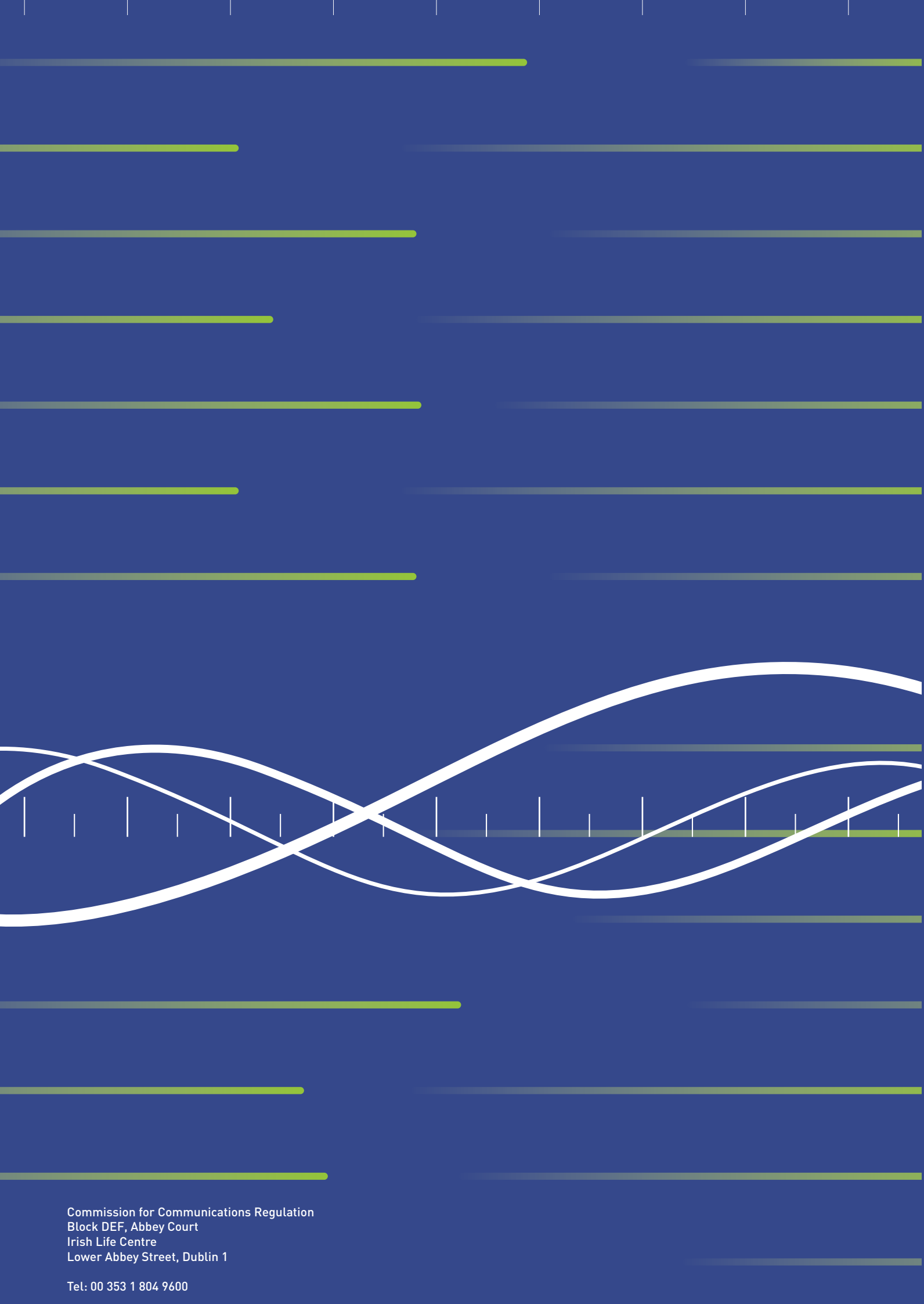
- Wireless Broadband Services:** Demand for “wireless DSL” type services means 3.5 GHz band in particular is heavily used and has reached saturation in some urban areas. (10.5 GHz) is used in these areas to provide additional capacity and 5.8 GHz is widely used in smaller towns and villages. 26 GHz is increasingly used to serve business users and trial services are underway at 40 GHz offering STM-1 or higher data rates.
- Broadcasting:** Digital TV is now in the majority of homes, many of which have multiple sets and rely on a mix of platforms for reception. Regional trials of mobile TV have been successful and there is now pressure from broadcasters and mobile operators to expedite analogue switch off to free up spectrum for national mobile TV multiplexes. DAB in band III is offering a range of new, specialist radio channels and L-band is being used to deliver mobile multimedia content to the latest generation of multi-mode phones. Portable and mobile content (TV and other audio / visual material receivable on hand-held devices) is a big growth market and there is pressure for access to UHF TV channels to deliver services to DVB-enabled mobile phones.
- Satellite:** Satellite is being used to deliver broadband backhaul to rural areas, which are then served by licence exempt wireless networks, typically in the 5.8 GHz band.
- Fixed links:** Strong growth in all bands above 15 GHz to provide infrastructure links for mobile and FWA networks.
- Licence Exempt Spectrum:** In addition to growing demand for licence exempt wireless broadband services, there is also increasing demand for spectrum to accommodate short range applications for broadband connectivity, RFID applications and automotive applications such as collision avoidance radars.

Summary of Anticipated Spectrum Demand trends

The following table summarises the anticipated trends in demand for radio spectrum by various sectors, based on the scenario described above.

- Key:
- ↑↑ = high demand growth anticipated
 - ↑ = moderate demand growth anticipated
 - ↔ = little change anticipated
 - ↓ = moderate decline anticipated
 - = demand not anticipated

	Below 3 GHz	3 – 15 GHz	Above 15 GHz
Mobile	↑	↔	-
Wireless Broadband	↑	↑↑	↑
Broadcasting (terrestrial)	↔	-	-
Satellite	↔	↔	↔
Fixed Links	↓	↔	↑
Licence Exempt	↑	↑	↑



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