



Commission for
Communications Regulation

Consultation Paper

Preparing the Radio Spectrum Management Strategy for 2005 - 2007.

An Examination of the Key Drivers Affecting Spectrum Demand, the Economic Impact of Spectrum Usage and a Review of Radiocommunication Services.

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All responses to this consultation should be clearly marked:-
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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. This consultation is the first step in formulating an update to this Strategy.

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 in Europe to introduce licence exempt wireless broadband access in the 5.8 GHz band (5725-5875 MHz) and in 2005 we will be introducing 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).

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

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

In developing our strategy it is important that ComReg elicits a wide cross-section of views on the proposals contained in this strategy consultation. ComReg welcomes comments from the public, users, industry, government and interest groups to the proposals contained in this document.

Isolde Goggin
Chairperson.

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 into the contribution made by 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 *proposed strategy* in each case for dealing with these issues in relation to one or more of the four *objectives* shown above. A detailed review of the current status of each of the services listed is given in the relevant part of *Annex B*.

Service	Key Issues	Proposed Strategy	Objectives	Annex B reference
All	Promotion and protection of use of the radio spectrum in Ireland	Continue to represent and promote Ireland's position with regard to all radio services in the relevant international fora, at both a regional (European) and global level, within the European Union (EU), International Telecommunications Union (ITU) and European Conference for Postal and Telecommunications Administrations (CEPT).	i, ii, iii, iv	
Public Mobile	Future expansion spectrum for 3G mobile services	Consider future of 2010 – 2025 MHz band for other services.	i, ii	B.3.5.1
		Consultation with industry to develop a coherent strategy to facilitate the development of Third Generation (3G) services in the 2.6 GHz band in line with market demand whilst accommodating any ongoing requirement by Multipoint Microwave Distribution System (MMDS) operators and their customers.	i, ii, iv	B.3.5.1
	Possible demand for content delivery to mobile platforms using digital broadcasting technology	Review spectrum options for Digital Video Broadcasting (DVB) and/or Digital Audio Broadcasting (DAB) based delivery of content to mobile platforms.	i, ii, iii	B.3.5.1
	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.	i, ii, iii	B.3.5.1
	Designation of 900 / 1800 MHz GSM bands for 3G mobile	Participate in European work on this initiative (work on an ECC Decision is expected to commence in 2005) and consult with all interested parties on implications.	i, ii, iii	B.3.5.1

Service	Key Issues	Proposed Strategy	Objectives	Annex B reference
Broadcasting	Introduction of digital broadcasting in Ireland	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.	i, ii, iii	B.4.5
		Continue planning and co-ordination for rollout of Digital Terrestrial Television (DTT) – the Department of Communications, Marine and Natural Resources (DCMNR) have stated that they seek 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.	i, ii, iii	B.4.2
	Sound Broadcasting	Ensure operator compliance and protect authorised services from illegal spectrum use.	iii, iv	B.4.5
		Prepare positions for ITU Conference Regional Radiocommunication Conference 2006 (RRC-06).	i, ii	B.4.5
	Television Broadcasting	Ensure operator compliance and protect authorised services from interference.	iii, iv	B.4.6

Service	Key Issues	Proposed Strategy	Objectives	Annex B reference
		<p>Prepare for RRC-06: ComReg is working with the Broadcasting Commission of Ireland (BCI), Radio Telefis Éireann (RTÉ) and the DCMNR 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.</p>	i, ii	B.4.6
		<p>See ‘Public Mobile’ above re future expansion of 3G services in the 2.6 GHz band.</p>	i, ii, iv	B.4.6
Fixed Terrestrial Services	Dealing with congestion/ encouraging efficient use	<p>ComReg will review the spectrum usage and requirements of licensees to ensure the continued efficient use of spectrum.</p>	i, ii, iii,	B.5.5
		<p>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.</p>	i, ii, iii	B.5.5
		<p>Encourage operators to use the latest technology in order to ensure efficient use of the spectrum.</p>	iii, ii	B.5.5
		<p>Review fixed links band frequency plans with a view to rationalisation where possible.</p>	i, ii, iii	B.5.5
		<p>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 point to point high capacity backbone links or for FWA services.</p>	i, ii, iii	B.5.5

Service	Key Issues	Proposed Strategy	Objectives	Annex B reference
		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	B.5.5
		Study the potential and demand for new fixed links bands, e.g. 58 GHz bands.	i, ii	B.5.5
		Study introduction of administrative incentive pricing to encourage use of more bandwidth efficient technologies in congested bands / areas.	iii	B.5.5
		Consider liberalised approach to new frequency bands (e.g. 4 GHz) to allow market forces to decide optimum use, e.g., for fixed links or fixed wireless access.	i, ii, iii	B.5.5
		Clear all remaining links from the old 1.5 GHz band to allow future introduction of Terrestrial Digital Audio Broadcasting (TDAB).	i, ii, iv	B.5.5
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	B.6.6
		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 of choice of equipment.	i, ii, iii, iv	B.6.6
		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	B.6.6

Service	Key Issues	Proposed Strategy	Objectives	Annex B reference
Licence Exempt Services	Development of new SRD products, applications and technologies	Facilitate new Short Range Device (SRD) applications by making spectrum available wherever possible for such applications, subject to demand and technical feasibility.	i, ii, iv	B.7.1.3
	Other Licence exempt services	Continue to exempt services from requiring a licence where this is appropriate in the Irish context.	i, ii	B.7.2.3
	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	B.7.2.3
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	B.8.4/B.9.5
	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	B.8.4/B.9.5
		Ensure spectrum is available for use by new emerging systems, in line with international requirements.	i, ii, iv	B.8.4/B.9.5
		Review fees associated with these licence types.	iii	B.8.4/B.9.5
Radar and Radionavigation	Efficient and effective use of spectrum for radar and radionavigation applications	ComReg proposes to introduce a once-off licensing fee for these services, subject to DCMNR approval. A once-off licence fee of around €500 for new stations is proposed, to cover co-ordination and notification costs.	iii, iv	B.8.4/B.9.5

Service	Key Issues	Proposed Strategy	Objectives	Annex B reference
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 and is proportionate to the existing fee structure.	i, ii, iii, iv	B.10.10
		Where possible, ComReg intends to exempt most low interference risk terminals which are typified by operating in harmonised spectrum to harmonised standards.	i, ii	B.10.10
Defence		Maintain an awareness of international developments.	ii, iv	B.11.3
		Liaise with the Defence forces as required to solve issues of mutual concern.	i, ii, iii	B.11.3
Business Radio		Continue to support the requirements of the Private Mobile Radio (PMR) industry and users.	i, ii	B.12.6.1
		Encourage the development and use of new technologies. Continue to support the requirements of the PMR industry and users.	ii, iii	B.12.6
		Review frequency bands with a view to ensuring there is adequate spectrum for the introduction of new and emerging digital technologies.	i, ii	B.12.6.1
		Continue to monitor PMR installations to ensure compliance with licence conditions.	iv	B.12.6.1
		Introduction of GSM for Railways (GSM-R) service: Adoption of ECC Decision (02)05 to allow for introduction of GSM-R in Ireland.	i, ii	B.12.6.4

Service	Key Issues	Proposed Strategy	Objectives	Annex B reference
		Consider appropriate licensing options for GSM-R service.	i	B.12.6.4
Public Safety Services		Ensure spectrum is available to meet the future needs of the emergency and law enforcement services.	i, ii	B.12.6.5
		Ensure spectrum is interference free.	ii, iv	B.12.6.5
Radio Experimenters (Amateurs)		Make frequency bands available on application.	i	B.13.5
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. Make available a number of frequency bands on application.	i, ii, iv	B.14.4
		Remain appraised of possible means of reducing unwanted emissions to protect Radio astronomy, Frequency and Time Services and other passive services.	ii, iii, iv	B.14.4
	Meteorological service protection	Continue to offer a high degree of protection to Meteorological services use of spectrum, in view of their use in the safeguarding of human life and property.	ii, iv	B.14.4
		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	B.14.4

Service	Key Issues	Proposed Strategy	Objectives	Annex B reference
Other Services	Wireless Public Address System	Introduction of a new service to meet the needs of religious and other community organisations.	i, ii, iii	B.15.1

3 Using This Document

The remainder of this document comprises the following:

Chapter 4 summarises the current framework in which spectrum management operates. This includes the national framework and legislation, the regional European framework and the international or global framework, and the interrelationship between them.

Chapter 5 presents a summary of the economic contribution arising from the main uses of radio spectrum in Ireland, in terms of gross domestic product, employment and benefits to industry and consumers.

Chapter 6 identifies the main drivers of future spectrum demand, including market, technology, social, economic and legal developments.

Chapter 7 presents an overview of ComReg's key strategic goals for radio spectrum over the next five years, considers how spectrum can be valued and outlines ComReg's position on the use of new, market-based approaches to spectrum management. The detail of the strategy for each service is given in Annex B.

Chapter 8 presents two projected future market scenarios, reflecting differing degrees of growth in demand for radio spectrum. The purpose of the scenarios is to estimate the future demand for radio spectrum by various sectors, based on hypothetical developments in markets, technologies and society. Scenario planning identifies key drivers of spectrum demand and makes contrasting assumptions on how these might develop in the future and the corresponding implications for spectrum management. The scenarios are described in general terms and ComReg would welcome comments on specific aspects of the scenarios, in particular any views that respondents have in regard to future demand for radio spectrum over the next decade. The scenarios will be refined in the light of comments received and any changes reflected in the final version of the spectrum strategy.

Chapter 9 gives details of how to submit comments in relation to the issue discussed.

The annexes provide detailed background information relating to ComReg's current approach to spectrum management and options for the future. **Annex A** presents a summary list of the questions addressed in the consultation. **Annex B** provides a detailed review of the current status of each radiocommunication service in Ireland and outlines ComReg's proposed spectrum strategy for each service. **Annex C** outlines ComReg's strategy with regard to monitoring spectrum use and ensuring compliance with spectrum regulations. **Annex D** provides additional detail on the current national and international framework in which spectrum management operates. The document is completed with a **Glossary** of terms.

4 Regulatory Framework for Spectrum Management in Ireland

4.1 Introduction

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.

Elements of Ireland's national spectrum management system are illustrated in Figure 1.

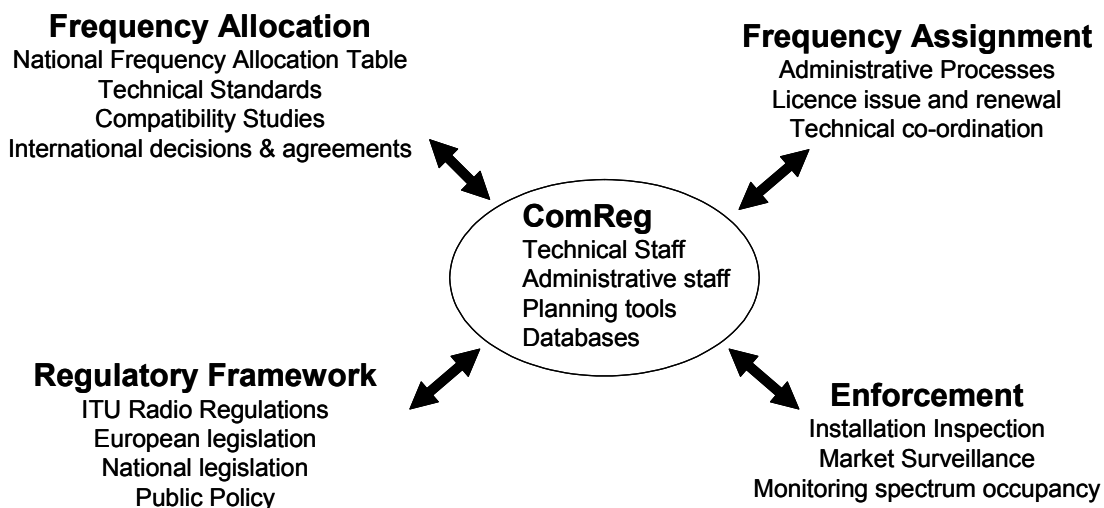


Figure 1: Elements of Ireland’s National Spectrum Management System

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 embrace 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 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 2 and 3 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.

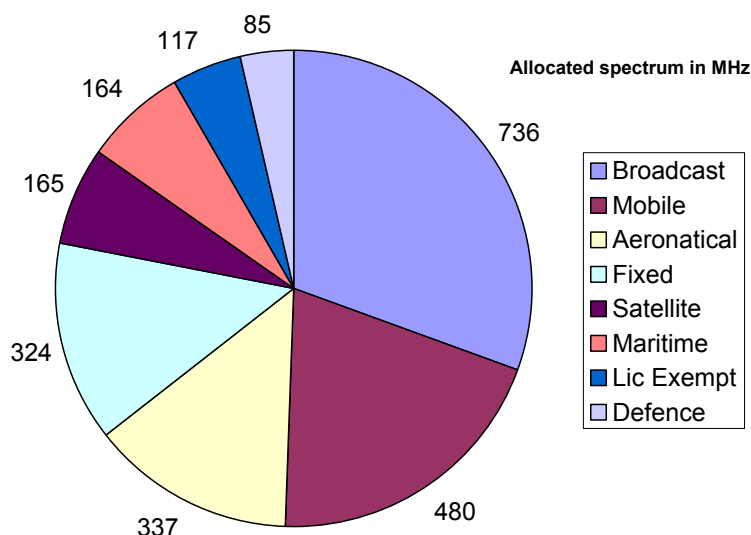


Figure 2: Principal Spectrum Allocations in Ireland in the VHF & UHF range (30 MHz to 3000 MHz)

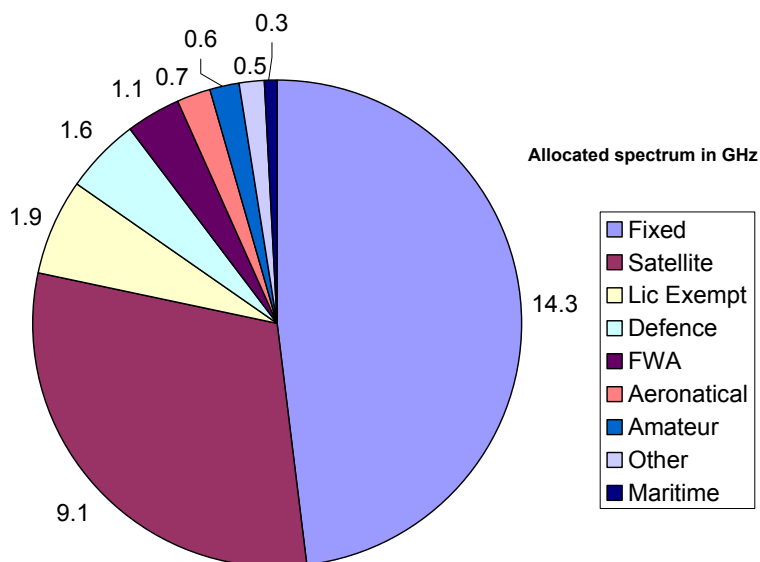


Figure 3: Principal Spectrum Allocations in Ireland in the microwave range (3000 MHz to 30 GHz)

Figure 4 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.

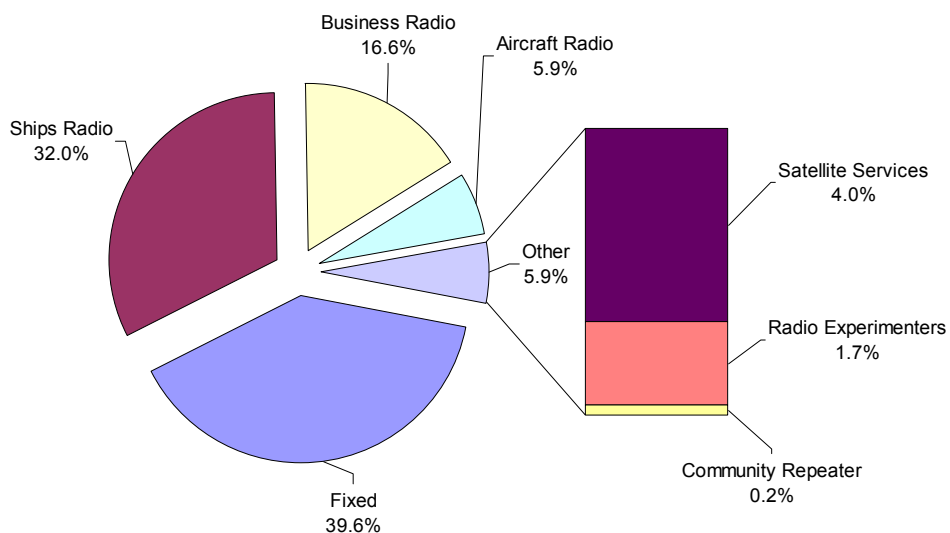


Figure 4: Breakdown of the total volume of licenses issued in the period May 2002 to October 2004

4.2 The International 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.

Figure 5 illustrates the International Spectrum Management Framework within which ComReg operates:

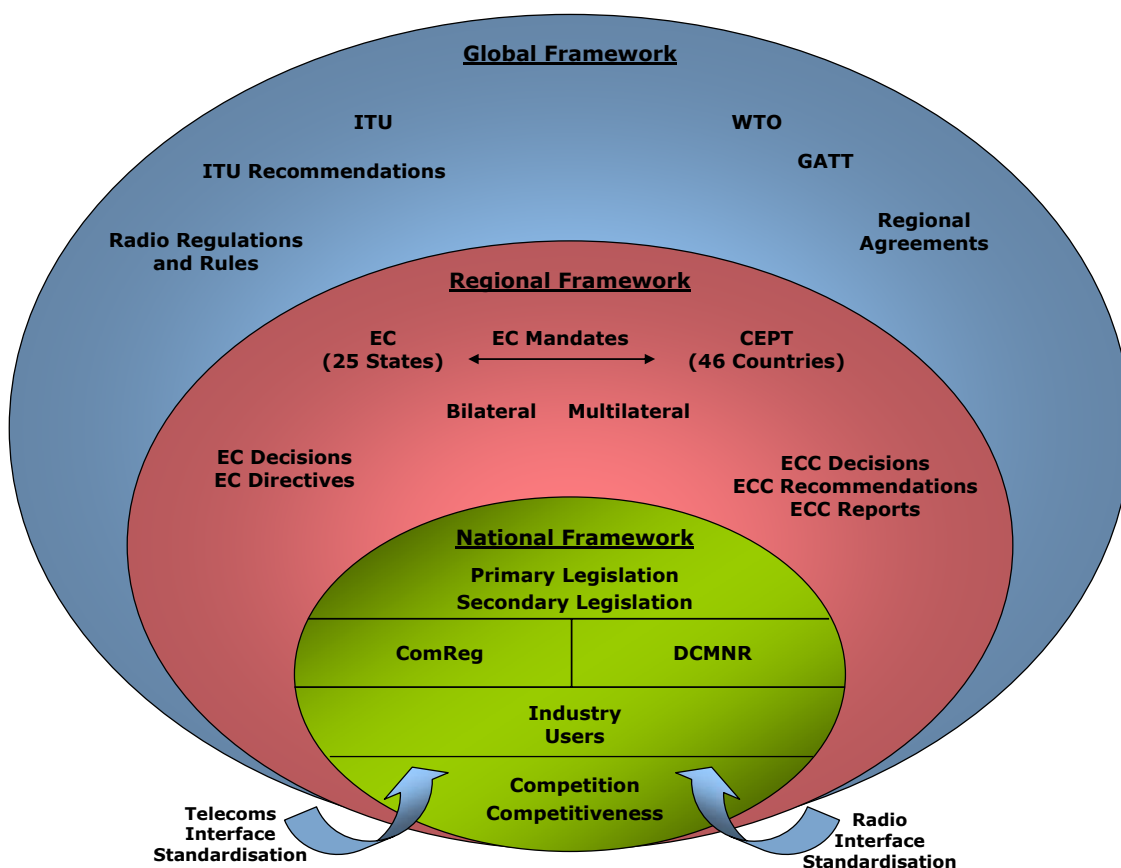


Figure 5: International Framework for Spectrum Management

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 5 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.

The role of these international bodies is described in more detail in **Annex D**.

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.

4.2.1 Proposed ComReg Strategy at the Global Framework Level

It is proposed that key elements of ComReg's strategy at the global framework level should continue to include:

- 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.

<p>Q. 1. Are there any further strategy options that need to be considered at the global framework level in order for ComReg to ensure correct engagement with regional and specifically European Union issues?</p>

4.2.2 *Proposed ComReg Strategy at the Regional Framework Level*

At the Regional Framework level the proposed 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)² 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 bi-lateral or multi-lateral agreements, as appropriate.

Q. 2. Are there any further strategy options that need to be considered at the regional framework level in order for ComReg to ensure correct engagement with regional and specifically European Union issues?

4.3 National Framework for Spectrum Management in Ireland

The national framework for spectrum management in Ireland is described in more detail in Annex D. The main aspects of this framework are summarised here.

4.3.1 *Role of ComReg*

In Ireland, ComReg is the National Regulatory Authority (NRA) responsible for the regulation of the electronic communications sector (telecommunications, radiocommunications and broadcasting³ 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;
- in meeting its objective to ensure the efficient management and use of the radio spectrum, ensure that measures taken are proportionate;

² 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).

³ 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.

- 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.

4.3.2 *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.

Until 2003, the WT Acts 1926-1988 provided the licensing framework for radio systems in Ireland. Under the WT Act, 1926, everybody requires an authorisation to keep and have apparatus for wireless telegraphy⁴ 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 1926 WT Act. Broadcasting distribution and transmission systems are subject to the new EU regulatory framework for electronic communications networks and services.

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 Directives⁵ (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.

In Ireland, the Framework, Authorisation, Access and Universal Service Directives were transposed into law under the following Regulations⁶:

⁴ 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".

⁵ Available at http://europa.eu.int/information_society/topics/telecoms/regulatory/new_rf/

⁶ Available at <http://www.dcmnr.gov.ie/files/>

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- S.I. 305 of 2003, European Communities (Electronic Communications Networks and Services)(Access) Regulations 2003 (“Access Regulations”);
- S.I. 306 of 2003 European Communities (Electronic Communications Networks and Services)(Authorisation) Regulations 2003 (“Authorisation Regulations”);
- S.I. 307 of 2003 European Communities (Electronic Communications Networks and Services)(Framework) Regulations 2003 (“Framework Regulations”);
- S.I. 308 of 2003 European Communities (Electronic Communications Networks and Services) (Universal Service and Users’ Rights) Regulations 2003 (“Universal Service Regulations”).

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 Acts relating to the regulation of the electronic communications sector will be enacted. These include a new 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.

5 Economic and Social Impact of Radio Spectrum Use

5.1 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 over €1.9 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 24,000⁷.

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.

5.2 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

⁷ These estimates are likely to understate the total contribution as it was not possible to value all services, because of lack of suitable data.

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 the annexes. 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.

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, details of the methodology for each service are contained in the relevant annexes.

	GDP (€m)		Employment	
	2002	2003	2002	2003
Mobile	569	834	8551	7928
Broadcasting	212	260	4093	4110
Fixed links ⁸	1	1	20	20
Air services	498	600	11988	11829
Short range devices	230	230	581	581
Other services	14	14	330	330
Total	1523	1925	25563	24798
% of total economy	1.1	1.4	1.4	1.4

Table 1: Summary of GDP and employment impacts

In addition, estimates of consumer and producer surplus have been produced in **Annex B** for some services. These are summarised in Table 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.

5.3 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

⁸ 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 (see Annex B).

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 satellite (VSAT) 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. The detailed assumptions and methodology made in all of these cases are contained in the annexes.

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

Table 2: Summary of GDP and employment impacts

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.

Q. 3. Is there any further detail ComReg has not taken into account in this general assessment of the economic and social impact of radio spectrum?

5.4 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 test-bed for companies wishing to test and develop new products and services over existing and emerging (and potentially competing) service bands (for example, over European, North American or Asian technologies).

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 as between operators or end-users, and as 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 up to 3 years. Particular blocks of spectrum are assigned to particular applications, and within those applications to particular users, in advance of knowing whether or not demand for those services materialises and whether or not those users are capable of meeting the 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 quo⁹. A recent study for the European Commission¹⁰ 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 report¹¹ by Forfás to the Minister for Enterprise, Trade and Employment identified wireless communications as an area of high potential growth, and recommended actions to promote the development of wireless as a sustainable internationally

⁹ See, for example, M. Cave, "Review of Radio Spectrum Management", March 2002, available at www.spectrumreview.radio.gov.uk

¹⁰ "Study of conditions and options in introducing secondary trading of radio spectrum in the European Community", Analysys, DotEcon and Hogan & Hartson; available at http://europa.eu.int/information_society/policy/radio_spectrum/docs/ref_info/secondtrad_study/secondtrad_final.pdf

¹¹ Wireless Communications: An Area of Opportunity for Ireland, April 2004, available at http://www.forfas.ie/publications/forfas040401/forfas_wireless_report_040401.pdf

traded sector from Ireland. These actions included a set of recommendations on accelerated liberalisation of spectrum management. The recommendations aimed at ComReg are listed in Annex E. 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 all R&D and 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 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 Panel, ComReg has established links with the third-level sector, 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 software sector. The Forfás report recommended that Ireland should focus its future development on its existing established strengths in 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, Science Foundation Ireland and the third-level sector. 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.

6 Key Drivers affecting future spectrum demand

6.1 Introduction

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 technology 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 areas are discussed in the following sections. A more detailed consideration of the key drivers of spectrum demand on a service by service basis is presented in **Annex B**.

6.2 Market Drivers

6.2.1 Introduction

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 could create demand for further mobile spectrum or access to alternative delivery platforms such as broadcasting technologies.

Some of the issues raised in each of these areas are discussed in the following sections.

6.2.2 *Convergence*

The electronic communications market is evolving rapidly with the launch of a range of new products and services such as third generation mobile (3G), the move to IP protocol based networks and services as well as the increasing take-up of digital television (DTV). There is also an increasing choice of transmission platforms over which content can be delivered to wireless devices, for example mobile phones are emerging that have integrated DTV receivers and can thus receive audiovisual content from either mobile or broadcast networks. In the future it seems likely that devices will connect to multiple networks and that there will be increasing “convergence” between traditionally distinct services like broadcast, fixed and mobile communications.

The introduction of services such as WLAN as a home networking technology has added a further stimulus towards convergence. What exact form this convergence may take is as yet unclear but the increasing combination of wireline, wireless, IP, content, multi-mode terminals and IT services to provide a ubiquitous and seamless service to end-users provides both new opportunities and challenges. The provision of networks and devices, which will not only provide voice telephony (using VoIP) and real time data transmissions but will also cover entertainment services ranging from music to photography. A converged future with wireless broadband, mobile or fixed broadcasting to wireless devices are already a reality in countries such as Korea and Japan.

Convergent services may include textual, audio (speech or music) and/or video material. In some cases convergence can involve elements from outside the wireless sector (e.g. Voice over IP). Radio spectrum has considerable potential for the mobile delivery of convergent services and content, and convergence is likely to have a significant impact on the economic contribution derived from the use of the radio spectrum.

Convergence is likely to require a more flexible approach to spectrum management than has traditionally been the case, although there will continue to be a need to ensure technical compatibility between different users of the radio spectrum. A key element of ComReg’s spectrum strategy is to introduce flexibility where this does not compromise the existing use of the spectrum.

6.2.3 *Demand for Fixed Broadband Services*

Broadband penetration levels have increased significantly across Europe in the past 12 months. Ireland despite being late with the introduction of a competitive Broadband offering, and lacking the competitive spur of Cable Broadband, which exists in many other markets experienced a 400% growth in penetration levels in 2004. While the process of catching up with other European countries is underway considerably more progress will be necessary if we are match or surpass the best international levels achieved in countries such as Denmark, Canada or Japan. As one of Europe's fastest growing economies, with a highly developed IT industry, the ready availability and take-up of competitive Broadband services is critical to both our competitiveness and our reputation as a location of choice for the high-tech sector.. In this context, apart from continuing to pursue supply-led initiatives more work needs also to be done to promote Broadband through awareness programmes and content driven initiatives.

Wireless Broadband has a significant role to play in achieving this key national objective by bridging the gap between Ireland and other EU/OECD countries that have more developed cable / DSL infrastructure. The success of the recent FWALA licensing initiative is a clear step in this direction and ComReg expects to see substantial growth in the wireless broadband sector over the next few years.

6.2.4 *Demand for Multi-Channel TV and Radio*

Around two third of Irish TV households already subscribe to cable, MMDS or satellite TV services that provide multi-channel services (i.e. channels other than the four Irish terrestrial channels). Many terrestrial viewers are also able to receive terrestrial broadcasts from the UK in addition to Irish services. This is likely to have implications for the introduction of terrestrial digital services, in that these services may have to offer a similar range of channels/services in order to compete effectively with cable and satellite options, or to satisfy consumer demand for mobile reception of multi-channel services.

As part of its spectrum strategy, ComReg and other bodies involved in broadcast regulation are considering the likely nature of terrestrial TV services post-analogue switchover and the spectrum required to support these services, taking account of the planning process being developed at RRC-04/06¹².

6.2.5 *Demand for Mobile Multimedia Content*

Demand for on-line content is likely to extend to the mobile environment as 3G phones become more commonplace. Cost-effective delivery of audiovisual material may require either additional spectrum or the adoption of novel technologies that combine mobile and broadcast media. New technology developments such as the DVB-H standard blur the traditional distinctions between broadcast and telecommunications services, enabling the delivery of both conventional TV

¹² The ITU Regional Regulatory Conferences taking place in 2004 and 2006 to re-plan the broadcast bands to accommodate digital services.

programmes and convergent multimedia content to mobile receivers in a manner that makes technically efficient use of available spectrum.

DAB may also have a role to play in supporting mobile multimedia services. Mobile phones incorporating DAB modules are expected to be available by 2006.

6.3 Technology Drivers and Enablers

6.3.1 Introduction

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;
- Technologies such as Ultra Wide Band (UWB), offering the potential to carry very large amounts of data;
- 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.

6.3.2 Improved Spectrum Efficiency

Use of advanced modulation and coding schemes can provide significant improvements in spectrum efficiency. For example, fixed links deploying the latest QAM modulation techniques can convey up to four times as much data in a given radio channel compared to earlier QPSK technologies. Similar improvements can be achieved with digital mobile and broadcasting technologies, however this can be at the expense of resilience (i.e. ability to cope with interference or obstructions to the transmission path). In other cases adaptive modulation systems are being employed to dynamically maximise spectrum efficiency for a particular band, application, and location.

OFDM (Orthogonal Frequency Division Multiplexing) techniques established in broadcasting and local area wireless data networks are being successfully applied to advanced mobile and portable systems. Time based modulation schemes (i.e. Pulse Position Modulation) are being applied to UWB (see below).

Adaptive or 'smart' antenna systems can be used to significantly improve spectrum efficiency of both new and existing wireless systems. For example MIMO (Multiple

Input Multiple Output) technology has been shown to improve the spectrum efficiency of a traditional mobile system from 1-5 bits/Hz to 40bits/Hz (Lucent V-Blast).

Advanced video coding schemes such as MPEG-4 can also yield significant improvements in spectrum efficiency, by enabling more programme channels to be delivered over a single radio channel. For example, one US chip designer¹³ has claimed that up to 24 MPEG-4 standard definition programmes can be transmitted using a single 6-MHz 256-QAM digital cable channel (compared to 8 – 12 for a conventional MPEG-2 solution), with video quality that meets or exceeds that of MPEG-2. Similarly advances are being made in coding other types of data (e.g. voice).

6.3.3 WiMAX

The term “WiMAX” describes a set of standards being developed to deliver broadband, wide area wireless communication over a wide range of frequencies between 1 and 60 GHz. The standards are being developed within the US IEEE standards body, under the IEEE 802.16 banner. This builds on the success of the established 802.11 series of standards that include the well known “Wi-Fi” standard and are widely used in wireless LANs and public wireless “hotspots”.

The WiMAX standard is being promoted globally by the WiMAX Forum, with over 100 industry players including Alcatel, Nokia, Intel and eircom. The Forum recently announced the formation of a Regulatory Working Group, tasked with improving availability of WiMAX spectrum worldwide.

WiMAX can be used to backhaul 802.11 hotspots and WLANs to the Internet, and enable a wireless alternative to cable and DSL for last mile broadband access. The Forum claims up to 50 km service area range where a line of sight is available and a typical working range of 5 – 8 km under non-line of sight conditions, with data rates of up to 280 Mbps per base station. It is suggested that WiMAX technology will be incorporated in notebook computers and PDAs in early 2006 allowing for urban areas and cities to become “hotzones” for outdoor broadband wireless access.

There are two main versions of WiMAX, 802.16d and 802.16e. The former is intended for fixed (indoor or outdoor) access, similar to existing FWA services, while the latter provides mobility (albeit limited, more properly described as “nomadic”, in that features like seamless handover are not available). WiMAX is not strictly speaking a new technology, but a more innovative and commercially viable adaptation of existing non-line of sight FWA technology such as that already being deployed by some Irish FWA operators.

The WiMAX Forum is currently focussing on the 2.5 GHz (licensed MMDS), 3.5 GHz (licensed FWA) and 5.8 GHz (licence-exempt FWA) bands, using both TDD and FDD technology. However the forum is also lobbying within the ITU to expand the frequency allocations. Two key issues raised by the emerging WiMAX

¹³ Sigma Designs Inc.

standards is the potential impact on future demand for licensed and licence-exempt spectrum in the bands concerned, and the potential to deliver mobile-type services in spectrum that was formerly considered only suitable for fixed applications.

6.3.4 *Cognitive Radio*

Cognitive radio is an area of advanced research that could one day lead to more efficient use of radio spectrum. The concept involves intelligent end user devices that are capable of adapting to a particular radio spectrum environment to most efficiently provide a particular service without causing interference to other users. For example, before transmitting a cognitive radio device would monitor radio spectrum to find the most suitable spectrum to efficiently deliver a required service at a given time and place, and would continue to adapt its mode of operation (e.g. change band or modulation scheme) in reaction to or anticipation of changes in the radio spectrum environment (e.g. increase traffic in a particular band). Ultimately, such systems could remove the need for international harmonisation of radio spectrum since individual radio devices could manage spectrum resources for themselves.

Software defined radio (SDR) is often considered along with cognitive radio since the ability for a device to carry out any level of ‘cognitive functions’ would require a sophisticated level of software programmability. SDRs are characterised by the use of general purpose programmable hardware in place of dedicated radio modules found in traditional radio systems. Traditional radio functions (e.g. modulation, filtering, and interference rejection) are then implemented digitally in software. The implementation of a software solution on a programmable platform results in a device that can potentially be re-programmed to operate innovative radio services in much the same way as a personal computer (PC) can be upgraded to run new software packages (i.e. future proofing devices). Re-programmable radio features are increasingly being incorporated in modern radio systems, particularly in cellular base stations.

Combining software radio with cognitive radio could help realise an advanced secondary market in spectrum where individual devices negotiate and acquire spectrum on one-off per-use basis. The technology could therefore be a key enabler of a more flexible approach to spectrum management over the longer term.

6.3.5 *Ultra Wide Band (UWB)*

UWB is a new technology which provides a means of wirelessly conveying large amounts of data over very short distances using very low power signals that are spread over a very wide bandwidth. UWB devices typically operate in the frequency range 1 – 10 GHz and standards are currently under development in European and US technical standards bodies.

One of the main concerns relating to UWB is the need to protect other narrower bandwidth systems that use the same spectrum. To achieve this, various “spectrum masks” have been proposed, defining limits on the power that can be radiated by UWB devices in specific parts of the spectrum. The current masks, as developed by the European Communications Committee (ECC), are intended to protect mobile services in the existing bands up to 2.2 GHz but concerns have been raised about the

potential impact of UWB on 3G mobile expansion spectrum in the 2.6 GHz band and more immediately in the FWA bands around 3.5 GHz. Further compatibility studies are underway in CEPT and the ITU to address these concerns. In the meantime, ComReg proposes to allow tests of UWB technology where the risk of interference is minimal, e.g. in specific geographic areas or indoor locations that provide appropriate electromagnetic shielding from potential interference victims¹⁴.

6.4 Social / Cultural Drivers

6.4.1 Introduction

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 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 using the digital TV platform itself or by making use of some of the UHF spectrum to extend broadband access in rural areas.

6.4.2 Extending Broadband Coverage

Wireless technologies are increasingly emerging as attractive alternatives for the coverage of rural and remote areas, where the upgrading of existing infrastructure can be particularly costly. For example, broadband wireless services have been established in a number of small towns in the Border Midland and West (BMW) region, with the support of the BMW regional assembly and wireless service providers. Mobile technology may provide a cost-effective solution to broadband access in more remote areas, for example the possibility of licensing broadband digital mobile radio in the 420 MHz and 900 MHz bands is currently under consideration by ComReg.

6.4.3 Future of Broadcasting Spectrum

The eventual switchover from analogue to digital television is expected to yield a substantial “spectrum dividend” of 50% or more of the current TV broadcast spectrum. With the adoption of flexible planning procedures based on allotment planning and the use of a “spectrum mask” for co-ordination purposes, rather than the current rigid assignment planning approach, international co-ordination could be less of a constraint on the use of this spectrum. This is particularly so in Ireland, which has fewer immediate geographic neighbours than most other European

¹⁴ See ComReg document 04/115 “Opportunities for trialling wireless services and technologies in Ireland”.

countries. There is therefore scope to consider potential alternative uses of this spectrum such as:

- (a) Increasing the number of programme services and/or enhancing the TV experience (e.g. multi-camera angles for sports, individual news streams and other quasi-interactive options that are accessed using the remote control);
- (b) Delivering services with higher technical quality (notably HDTV) or to portable and mobile receivers;
- (c) Enabling electronic communication services other than broadcasting.

The latter option might be appropriate in a largely rural country for the provision of broadband access, perhaps using a similar approach to that recently proposed by the FCC in the US¹⁵.

6.4.4 Access to Spectrum for Government Services

Future requirements for security and public safety will need to be considered as part of the spectrum strategy. This includes upgrading of existing analogue mobile communication services, which could lead to release of existing spectrum in the UHF bands for civil use, and potential requirements for broadband communications to support security, such as wireless CCTV.

6.4.5 Improved Traffic Management and Public Transport

Radio spectrum can play a significant role in the transport sector, enabling cost-effective traffic monitoring and toll collection and the distribution of real-time information to public transport users. For example a number of European cities now provide real-time information on local bus services, using a combination of vehicle tracking technology and either a private or public mobile radio network to relay the information to bus stops. It is important that suitable spectrum can be made available to support such initiatives where required.

6.4.6 Environmental Issues

Concerns about the proliferation of radio masts have increased pressure on spectrum users to share existing radio transmission sites and may in the future constrain the extent to which radio channels can be re-used in some areas. This may necessitate more spectrum in order to make optimum use of existing sites. Expanding coverage, e.g. for broadband access, has implications for transmission infrastructure, including radio masts. Sharing of existing masts should be encouraged wherever possible, building for example on the code of practice that applies to 3G mobile operators.

¹⁵ The FCC has proposed that parts of the UHF TV spectrum could be used for delivery of broadband wireless services to rural areas where the spectrum is not used by broadcasters, using cognitive radio technology to avoid interference to TV services.

6.5 Economic Drivers

Many of the services that use 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. Employment patterns will also have a bearing, for example increased working from home could spur demand for broadband connections.

According to a recent report from the Economist Intelligence Unit, Irish GDP growth is expected to remain steady at 4.9 per cent next year, with inflation to stay at low levels of about 2 per cent¹⁶. According to the forecasters, economic growth will come as private consumption strengthens on the back of a more optimistic economic outlook and a more robust outlook for jobs and incomes, according to the analysis, suggesting strong growth prospects for wireless communication services. This could be compounded by increasing levels of traffic congestion, leading to increased use of home working, driving demand for mobile and broadband services.

6.6 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 (see section 8.2). 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, i.e., the ability to use spectrum for purposes other than it was originally licensed for, is likely to be a key enabler of technology convergence. For example, it is likely that in the future spectrum currently used for broadcasting could 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 alike¹⁷.

In the next 2-5 years it is expected that a number of new Acts relating to the regulation of the electronic communications sector will be enacted. These include a new 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.

¹⁶ Source: Irish Times. 4th December 2004

¹⁷ i.e. current users of spectrum operate with knowledge of alternative uses for occupied spectrum and potential use of adjacent band spectrum.

7 Strategy for Managing the Radio Spectrum

7.1 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, 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 presented in Chapter 8 are intended to assist with such considerations.

The strategy is developed in the context of the global, regional (European) and national regulatory framework that governs spectrum use in Ireland, as described in Chapter 4 and Annex D of this document.

A number of specific goals have been identified in each of the above areas and are summarised briefly in the following section. ComReg has also identified a number of issues in relation to specific radio services that require consideration in order to meet the broad strategic objectives described in the previous chapter. Section 7.3 outlines the key issues and ComReg's proposed strategy for each service.

ComReg has been considering the role that spectrum licence charging mechanisms and market based mechanisms, such as auctions and secondary trading, might have in supporting ComReg's spectrum management objectives in the future. ComReg's position on these issues is presented in Sections 7.4 and 7.5 respectively.

Views are sought on a number of specific issues that are raised in this chapter.

7.2 Innovation

Creating a regulatory environment supportive of innovation in new electronic communications services is critical to positioning Ireland at the forefront of wireless developments so as to realise the benefits of a vibrant telecommunications industry for Irish society. 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). As part of this project ComReg chairs a CEPT project team with the aim of developing a harmonised approach to 5.8 GHz wireless broadband access across Europe;
- the Trial Licence scheme¹⁸, to be introduced early in 2005, will be 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 will allow 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.

7.3 Key Strategic Goals for Spectrum Management

7.3.1 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;
- to facilitate new and innovative services;
- support and promote innovation, research and development in new radiocommunication techniques, spectrum-based services and applications;
- review the 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;

¹⁸ See ComReg Document 04/115: Opportunities for Trialling Wireless Services and Technologies in Ireland.

- to 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.

7.3.2 Maximising Economic and Social Benefits

- ComReg will seek to further opportunities to promote the use of radio/wireless systems to enhance Ireland's competitiveness;
- 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, safety of life services and the defence forces 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 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 test-bed for wireless system testing and service trials.

7.3.3 Promoting the Efficient Use of Scarce Spectrum Resources

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

7.3.4 *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. A comprehensive review of the status of each radiocommunications service in Ireland is presented in **Annex B**.

Q. 4. What are your views on the policies detailed above?

Q. 5. Are there any further broad strategic issues that would be appropriate for consideration?

7.4 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 is the additional economies of scale and profit that an operator can earn by supporting more users or offering a better quality (or safer) 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 calls for help 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).

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.

7.5 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 market and technologies. In particular, ComReg recognises that convergence between the fixed, mobile and broadcast sectors (see Section 6.2.2) 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 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 which will allow licence holders substantially greater flexibility in how they use the spectrum than existing business radio licences. 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.

Q. 6. Do you agree that a more flexible approach to spectrum allocation and licensing will be required to accommodate market and technology convergence? If you do agree, for which aspects of spectrum management and licensing would you particularly favour a more liberalised approach?

7.6 Use of Market Mechanisms for Spectrum Management

7.6.1 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 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).

7.6.2 Auctions

Comparative selection procedures, otherwise known as ‘beauty contests’, are an important spectrum management tool which allow a regulator to achieve specific policy objectives such as coverage to rural areas, roll-out of networks within a particular timeframe, delivery of specific services, etc. One of the challenges in designing a beauty contest is establishing an appropriate fee for access to the spectrum. Auctions, if well constructed and operated, will deliver a market-determined price for the spectrum and are generally regarded as being less likely to

raise legal challenges than comparative selection procedures. However it is important that the auction is designed to treat all potential bidders fairly and transparently, and to achieve a realistic market price for the spectrum concerned in order to encourage its efficient use. Auctions were used by a number of European countries for the award of 3G mobile licences and concerns were raised about the very high prices paid in the earliest auctions (notably Germany and the UK). However, subsequent auctions yielded relatively stable and substantially lower payments on a per capita basis, indicating that the market had reached a consensus on the value of the spectrum on offer.

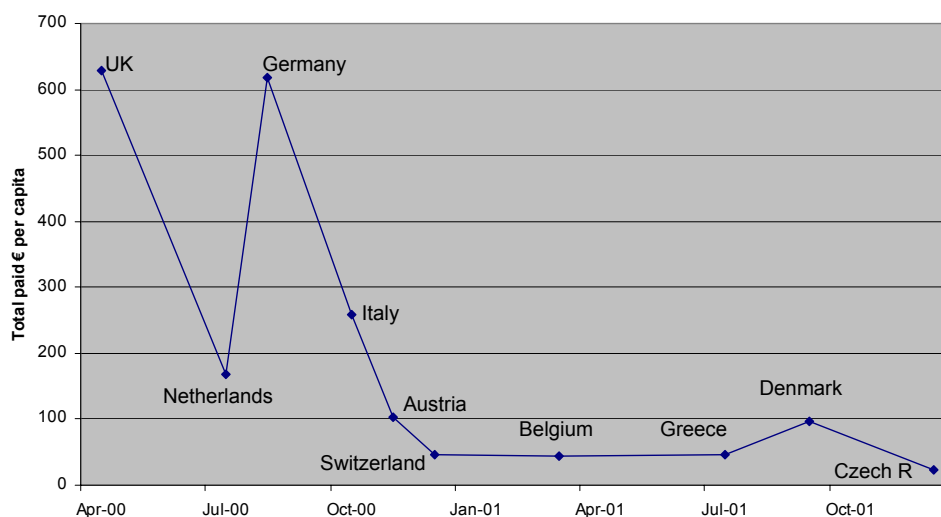


Figure 6: Total price paid per capita in European 3G mobile auctions (source: Aegis)

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. In the future ComReg may consider the use of auctions as an alternative to comparative selection procedures for future spectrum assignments.

Q. 7. Do you favour the use of auctions or comparative selection procedures for awarding spectrum rights of use where the number of rights is limited? Please provide reasons to support your view.

7.6.3 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, which are described briefly in the following sections. These 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.

7.6.3.1 Transfer of Undertakings

This simply involves the transfer of a right of use from one organisation to another, in line with existing rules for many licences. Transfer of undertaking involves no change to the conditions attached to the right of use, such as the duration (if specified) and any obligations such as coverage, tariffs or service quality. In the case of large radio networks using scarce radio spectrum (such as GSM or 3G mobile networks) competition issues could arise if, for example, an existing operator wished to merge with or take over a competitor. In such cases it is likely that only one of the existing rights of use would be retained and the other would be returned to the regulator for re-licensing.

7.6.3.2 Re-Configuration

Re-configuration refers to the situation where a right of use changes hands but the new user wishes to change certain aspects, such as the coverage area. This might arise, for example, if a number of local Business Radio or FWALA licences are acquired by a single company that wants to operate them as a single network covering a contiguous area. This may involve changing the location or technical characteristics of some of the base stations. Any changes arising from re-configuration would only affect the conditions attached to the right of use and not change the type of use (e.g. business radio, community repeater, FWALA, etc).

7.6.3.3 Partial Trading of Spectrum

The situation may arise where a user has more spectrum than is needed, or has insufficient spectrum and would like to acquire more. In these situations there may be benefit in being able to “disaggregate” the licensed spectrum and to trade part of the spectrum with another user.

7.6.3.4 Spectrum Leasing

The ability for a licensee to hire or lease spectrum to another user on a short or longer term basis could allow occasional spectrum users to gain the benefits of access to spectrum without having to apply for their own licence. If incumbent spectrum licensees who do not require all of their spectrum at all times (such as government users) are able to benefit financially from hiring or leasing spectrum they may be persuaded to allow others to use parts of their spectrum when or where it is not required. Leasing could also allow new users to get access to spectrum on mutually agreed terms without the existing user having to relinquish the spectrum permanently.

7.6.3.5 Change of Use

Change of use goes considerably further than re-configuration, in that not only the conditions attached to the right of use are changed, but the type of right use of use also changes. In some cases, a user may wish to split a licence to use different parts of the spectrum for different kinds of service, perhaps selling part of the spectrum in the process. Change of use raises potentially complex issues, for example in relation to interference where different technologies are deployed.

7.6.3.6 ComReg Position on Spectrum Trading

ComReg is currently considering the potential benefits of spectrum trading for specific licence categories. Under the proposed new licensing scheme for National Business Radio channels, ComReg is considering provisions for trading of licensed frequencies and for leasing of frequencies to third parties. Similar provision may be extended to other services in the longer term where considered appropriate.

- Q. 8. Should ComReg make provisions for trading of spectrum rights in the future and if so what form should this take?
- Q. 9. Should ComReg make provision for change of use of spectrum as outlined in Section 7.6.3.5?

7.7 Strategy for Specific Radio Services

This section provides a summary of ComReg's strategies for each of the different radio services. Further information on these services and on the background to these strategies are provided in Annex B. In answering the questions, readers may find it useful to refer to Annex B for further information.

7.7.1 Public Mobile Services

Radio is vital to the development of ubiquitous public mobile services. In light of market reviews currently being undertaken under the new EU framework for electronic communications, ComReg's strategy in this area may need to be further reviewed. To support the continued development of public mobile services ComReg's strategy will address the following issues:

7.7.1.1 Future Expansion Spectrum for 3G Mobile Services

- 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.

- Q. 10. Should the band 2010 – 2025 MHz be made available for other services on a technologically neutral basis?
- Q. 11. What should those services be and why should they be considered for this band?

7.7.1.2 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), (See Annex B). ComReg has identified the following options for this spectrum:

- Do not use the unassigned spectrum until required by the current licensed operators;
- Assign part (e.g. half) of the spectrum to the existing licensed operators with the remaining spectrum left for the introduction of innovative services;
- Consider, where appropriate, if other options to licence spectrum at a regional or national level may exist;
- Assign the spectrum for innovative wireless services;
- Assign rights of use for this spectrum, in say 200 kHz blocks, via an auction or beauty contest to interested parties with no restrictions, beyond those required to meet international obligations, on the type of services to be introduced;
- Extend similar liberalisation to existing licensees.

Q. 12. Which of the above approaches do you prefer and Why?

Q. 13. Within what timeframe do you consider ComReg should make this spectrum available?

Q. 14. Are there other spectrum options that should be considered by ComReg?

7.7.1.3 Possible Demand for Content Delivery using Digital Broadcasting Technology

- ComReg will review spectrum options for DVB and/or DAB based delivery of content to mobile platforms.

Q. 15. Do you consider that there will be significant demand for DVB or DAB technologies?

7.7.1.4 Demand for Innovative Wireless Services

- ComReg is considering the potential demand for innovative wireless services and, as appropriate, possible future spectrum allocations;
- ComReg will consider possible future uses for the remaining GSM and IMT-2000 spectrum.

7.7.1.5 Quality of Service

- ComReg will continue regular Quality of Service audits on GSM and extend the audits to 3G networks.

7.7.2 *Broadcasting*

In support of the continued development of broadcasting services ComReg's strategy will address the following issues:

7.7.2.1 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 operator compliance and protect authorised services from illegal spectrum use;
- prepare positions for ITU Conference RRC-06.

7.7.2.2 Television Broadcasting

- ensure operator compliance and protect authorised services from interference;
- prepare for RRC-06: ComReg is working with the BCI, RTÉ and the DCMNR in preparation for the forthcoming ITU Regional Radio Conference in 2006 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-06 will form the basis for VHF/UHF broadcasting in Europe for possibly the next 20 to 30 years;
- see "Public Mobile" above re future expansion of 3G services in the 2.6 GHz band.

7.7.2.3 Introduction of Digital Terrestrial Broadcasting in Ireland

- Continue planning and co-ordination for rollout of DTT. DCMNR have stated that they seek 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.

7.7.3 Fixed Terrestrial Services

Here, ComReg's basic objective is to encourage the use of fixed links for infrastructure and competition development, for the maximum benefit of all users and in particular new market entrants. As networks develop and as congestion in the fixed links bands grow, the strategy will be to encourage established fixed link licensees to migrate to fibre based infrastructure. To support this objective ComReg has devised a number of strategies as follows:

7.7.3.1 Dealing with Congestion/Encouraging Efficient Use

- ComReg will review the spectrum usage and requirements of licensees to ensure that all licensees continue to use spectrum efficiently;
- ComReg will encourage operators to use the latest technology such as CCDP equipment or higher modulation schemes in order to ensure efficient use of the spectrum. In this regard, ComReg is studying administrative pricing policies;
- ComReg will study the introduction of administrative pricing to encourage use of more bandwidth efficient technologies in congested bands / areas;
- 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 point to point high capacity backbone links or for FWA services (See Section 7.6);
- ComReg will consider a liberalised approach to new frequency bands (e.g. 4 GHz) to allow the market to decide optimum use e.g. for fixed links or fixed wireless access;

Q. 16. Do you have a view on the future use of the 4 GHz band?
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- 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 review the fixed links frequency bands with a view to rationalisation where possible;
- it is the intention to clear all remaining links from the old 1.5 GHz band to allow future introduction of TDAB;
- ComReg will study the use of 26 GHz band with a view to developing it for point to multipoint applications (Also see Wireless Broadband Services);
- ComReg will study the potential and demand for new fixed links bands e.g. 58 GHz band.

Q. 17. Is there any demand to open the 58 GHz band and if so what typical applications are envisaged and what licensing method would be most appropriate?

7.7.4 *Wireless Broadband Services*

To support the national objective of bringing Irish broadband penetration into line with other EU countries, ComReg will:

- continue to develop 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;
- 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 of choice of equipment.

Q. 18. Do you have a view on the balance between licensed and licensed exempt spectrum that will best facilitate wireless broadband? (see Section B.6)

- 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;
- encourage introduction of new cost-effective wireless technologies e.g. based on the WiMAX standard;
- seek opportunities for further licence-exempt FWA services.

Q. 19. How can wireless broadband applications and technologies best facilitate the rollout of broadband access in Ireland?

7.7.5 *Licence Exempt Services*

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

7.7.6 *Aeronautical and Maritime*

7.7.6.1 Maintaining safe and effective aeronautical and maritime communications

- ComReg will continue to provide protection from interference for aeronautical and maritime safety of life services.

7.7.6.2 Availability of Spectrum for New Applications

- ComReg will promote the use of spectrum efficient technologies in the aeronautical and maritime bands, thereby maximising the spectrum available for growth and new applications;
- ensure spectrum is available for use by new emerging systems, in line with international requirements;
- review fees associated with these licence types.

7.7.6.3 Radars and Radionavigation

To ensure efficient and effective use of spectrum for radar and radionavigation applications, ComReg proposes to introduce a licensing regime for these services, subject to DCMNR approval. A one-off licence fee of around €500 for new stations is proposed, to cover co-ordination and notification costs.

Q. 20. Do you agree with the proposal to introduce a licensing regime for the use of aeronautical and maritime radionavigation systems?

Q. 21. Do you agree with the proposal for different rates for existing, new services and changes to existing licences?

7.7.7 *Satellite Services*

To encourage the development of this service 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.

7.7.8 *Defence Services*

In the past ComReg's strategy has been to encourage use of spread spectrum technologies in all defence forces' bands 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 solve issues of mutual concern.

7.7.9 *Business Radio*

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

- continue to support the requirements of the PMR industry and users;
- 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;
- continue to monitor PMR installations to ensure compliance with licence conditions;
- proceed with making spectrum available for wideband PAMR services in the 410 – 430 MHz and 872 – 876 / 917 – 921 MHz bands;
- consult on proposals to introduce a new national business radio licensing scheme, which would permit the trading of licences or the leasing of licensed frequencies to other parties where not required by the licensee;
- ComReg intends to introduce a licensing scheme for paging systems to replace the current system of permits. This will bring paging into line with other forms of business radio. A one-off licence fee of €50 per base station is proposed to cover ComReg's administration costs;
- ComReg plans to adopt ECC Decision (02)05 to allow for the introduction of GSM-R (GSM for Railways) in Ireland;
- consider appropriate licensing options for the GSM-R service.

Q. 22. Do you agree with the proposal to introduce a licensing regime for paging permits?

Q. 23. Do you agree with the proposal to charge a one off licence fee of €50 per base station for all existing and future paging systems?

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 interference free.

7.7.10 *Experimenters*

Where possible, ComReg will make frequency bands available on application.

7.7.11 *Science Services*

ComReg will review requirements in these bands and:

- 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;
- continue to offer a high degree of protection to 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.

In common with the proposal for aeronautical and maritime radar, ComReg proposes to introduce a licensing regime for meteorological radars, subject to DCMNR approval. A one-off licence fee of around €500 for new stations will apply, to cover co-ordination and notification costs.

Q. 24. Do you agree with the proposal to introduce a licensing regime for the use of meteorological radars?

Q. 25. Do you agree with the proposal for different rates for existing, new services and changes to existing licences?

7.7.12 *Miscellaneous Services*

7.7.12.1 Wireless Public Address Systems

ComReg is proposing to permit Wireless Public Address Systems in the band 27.6 - 27.99 MHz in order to meet the needs of religious and other community organisations. There are currently 35 unassigned channels in this band. Wireless Public Address Systems consist of short range, inexpensive, off the shelf equipment. A one-off fee of €25 is proposed to cover ComReg's administration costs.

Q. 26. Do you agree that there is a demand for the provision of religious and community based Wireless Public Address services in Ireland?

Q. 27. Do you agree with the proposal to permit Wireless Public Address Systems in the 27.6 – 27.99 MHz band?

Q. 28. Do you agree with the proposal to charge a €25 processing fee per application?

7.7.12.2 Temporary use of the 24 GHz band for Automotive Short Range Radar

See Section Annex D 2.5 for further information on this issue. A recent CEPT ECC Decision¹⁹ opens the 24 GHz band (24.15 GHz ± 2.5 GHz) for SRR in vehicles, on a non-interference and non-protected basis for a limited period. This period is either until 1 July 2013 or until a 7.0% penetration of equipped vehicles in any European national market is met - whichever occurs first.

Q. 29. Do you have any views or opinions on the implementation of this Decision in Ireland?

¹⁹ ECC Decision ECC/DEC/(04)10 of 12 November 2004 on the frequency bands to be designated for the temporary introduction of Automotive Short Range Radars (SRR) (available at www.ero.dk)

8 Planning for the Future: Two Scenarios for Wireless Market Evolution

8.1 Introduction

The strategy described in chapter 7 has been developed in response to the spectrum demand drivers discussed in chapter 6, 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 is undertaking a scenario planning exercise, in which two distinct future scenarios for the electronic communications market are assumed. One scenario assumes rapid and substantial growth in the market for mobile, broadcast and broadband services along with a high degree of convergence, while the other assumes a more gradual evolution of the market. In each case, the implications for spectrum demand will be considered, and the extent to which ComReg's strategy will enable this demand to be met will be assessed.

The following sections provide a background to the scenario planning process and outline the draft scenarios that ComReg is currently considering. A number of questions are raised concerning specific aspects of the scenarios, with a view to developing the scenarios further in the light of respondents' feedback. The spectrum strategy will then be reviewed to ensure that it has the necessary elements to meet the spectrum demands identified in the two scenarios.

8.2 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 is using a scenario planning approach, under which two contrasting scenarios are developed representing different degrees of demand growth for radio services and the implications for spectrum demand are 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 scenarios described below represent plausible futures driven by trends and other factors we can see developing today. This grounds the scenarios in reality whilst providing scope for exploration of potential change and uncertainty.

8.3 Two Scenarios for Ireland

To guide our long-term planning we have developed two possible scenarios for the future state of radiocommunications services in Ireland, over a ten year timescale. The first scenario, “wireless boom”, envisages 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” envisages a more gradual evolution of the market. The first scenario envisages major changes in the way spectrum is used to deliver services, driven by market and technological developments, whereas the second scenario implies a more gradual and ad-hoc approach to accommodate a limited range of new services. Both of the scenarios are based on a view of the sector in December 2004.

ComReg plans to develop the scenarios further and to use them to test whether its spectrum strategy has the necessary flexibility to accommodate two very different evolutionary paths. ComReg is keen to ensure that each scenario is as realistic as possible given the information available and would welcome feedback on the assumptions made in each case. Any feedback will be taken into account by ComReg in developing the scenarios.

8.3.1 “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).

Q. 30. The key assumptions made under this scenario are summarised in the following table. For each assumption, please indicate your opinion of the likelihood of the assumed situation arising over the next 3 – 5 years, using the following scale:

- 1 = very unlikely to happen
- 2 = unlikely to happen
- 3 = no particular view
- 4 = likely to happen
- 5 = very likely to happen.

Please provide any comments on the individual assumptions on a separate sheet

Assumptions for Wireless Boom Scenario

Ref	Assumption	Likelihood
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.	
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.	
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.	
iv	Mobile digital TV and delivery of audio visual content to mobile phones is commonplace, using the DVB-H standard.	
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.	
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	
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.	
viii	Regional wideband PAMR services have been established to cater for specialist users.	
ix	Backbone radio links have largely been superseded by extensive fibre infrastructure but there is continuing growth in demand for access and infrastructure links in higher frequency bands (above 12 GHz).	

Q. 31. What other assumptions, if any, would be appropriate in developing this “Wireless boom” two scenarios? Do you have any further comments on this scenario?

8.3.2 “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.

Q. 32. The key assumptions made under this scenario are summarised in the following table. For each assumption, please indicate your opinion of the likelihood of the assumed situation arising over the next 3 – 5 years, using the following scale:

- 1 = very unlikely to happen
- 2 = unlikely to happen
- 3 = no particular view
- 4 = likely to happen
- 5 = very likely to happen.

Please provide any comments on the individual assumptions on a separate sheet

Assumptions for Steady Growth Scenario

Ref	Assumption	Likelihood
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.	
ii	Mobile data remains a niche market, 3G coverage restricted to main urban areas, no immediate demand for more spectrum.	
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.	
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.	
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.	
vi	Continuing reliance on radio for backbone networks has led to congestion in some frequency bands.	
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	

Q. 33. What other assumptions, if any, would be appropriate in developing this “Steady Growth” scenarios? Do you have any further comments on this scenario?

Q. 34. Which is the most likely scenario that Ireland will face in the short to medium term?

9 Submitting Comments

All comments are welcome; however it would make the task of analysing responses easier if comments were referenced to the relevant question numbers from this document.

The consultation period will run from 10 January 2005 to 4 March 2005 during which period, the Commission welcomes written comments on any of the issues raised in this paper.

Having analysed and considered the comments received, ComReg will review the proposed spectrum strategy and publish a report in April 2005 on the consultation which will, inter alia, summarise the responses to the consultation. This report will be followed by the publication of a finalised strategy for management of the radio spectrum for the period 2005 - 2007.

In order to promote further openness and transparency ComReg will publish the names of all respondents and make available for inspection responses to the consultation at its Offices.

Please note ComReg appreciates that many of the issues raised in this paper may require respondents to provide confidential information if their comments are to be meaningful. Respondents are requested to clearly identify confidential material and if possible to include it in a separate annex to the response. Such information will be treated as strictly confidential.