



Commission for  
**Communications Regulation**

**Ofcom**  
OFFICE OF COMMUNICATIONS

## **Award of available spectrum: 1785 - 1805 MHz**

This document consults on the proposed grant of licences to use this spectrum in Ireland and Northern Ireland and the associated auction processes

Consultation

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## Section 1

# Foreword

The publication of this joint consultation document marks a new milestone in co-operation between the Commission for Communications Regulation (ComReg) and the Office of Communications (Ofcom) in considering the development of spectrum use in both parts of the island of Ireland. Radio waves can pass freely across national borders: this initiative creates the opportunity for innovative wireless services to emerge in both administrations.

As Member States of the European Union Ireland and the UK share the same EU regulatory framework for electronic communications. We can therefore explore innovative approaches to securing optimal use of the radio spectrum for the benefit of citizens and consumers throughout the island of Ireland.

We look forward to the responses of stakeholders to our proposals.

**Isolde Goggin**

Chairperson  
Commission for Communications  
Regulation

**Stephen Carter**

Chief Executive  
Office of Communications

## Section 2

# Executive summary

- 2.1 This document consults on the proposed award of spectrum licences by ComReg and Ofcom, the Irish and UK national regulatory authorities. It sets out in detail proposals to award, through separate auction processes, wireless telegraphy licences to use the Spectrum Band 1785–1805 MHz (the Spectrum Band).

### An overview of key proposals

- 2.2 Auctions are proposed for the award of wireless telegraphy licences authorising the use of the Spectrum Band. For jurisdictional reasons these auctions must be separate legal processes. But in order to provide an opportunity for service providers to use the spectrum as efficiently as possible and to address the largest possible market it is proposed to plan and award wireless telegraphy licences in a co-ordinated way. This means that, as far as possible, the key elements of the proposed spectrum packaging and licensees' rights and obligations, whilst legally separate in each jurisdiction, will be identical.
- 2.3 The proposal to use auctions as the method for assignment and the other proposals relating to the details of this award are consistent with the aims and objective for the award, and in particular the aim of securing optimal use of the spectrum. The objective is not to raise revenue by means of spectrum auctions given ComReg's and Ofcom's duties and functions.

### Auction design options

- 2.4 The feasibility of a co-ordinated spectrum award is largely determined by the ability to construct, on spectrum efficiency grounds, co-ordinated processes that maintain the legally separate powers of Ireland and the UK and legally separates the licences awarded and managed by the respective jurisdictions. The special nature of this proposed spectrum award arises because of the potential additional spectrum and economic efficiencies available.
- 2.5 The pros and cons of the various options for granting spectrum licences in a co-ordinated, objective, transparent and non-discriminatory manner have been examined. From this examination a sequential sealed bid auction has been identified as the most suitable option from the many that are potentially available for the award.
- 2.6 The auction design options are discussed in section 8 and in Annex E.
- 2.7 Table 2.1 below sets out in summary form both ComReg's and Ofcom's proposals for the licence awards.

**Table 2.1 Summary of proposals**

	<b>Ireland<sup>1</sup></b>	<b>Northern Ireland</b>
<b>Spectrum Packaging and Licensing</b>		
Usage restrictions	There are no application specific restrictions. The licences will be technology and application neutral.	
Number of licences	One in Ireland.	One in Northern Ireland.
Spectrum band	The spectrum block to be auctioned is 20 MHz from 1785-1805 MHz and is un-paired.	
Transmission rights	Licensees will have the transmission rights specified in section 6. This includes: - the right to use the Spectrum Block for any technology and any application; and - A maximum equivalent isotropic radiated power (EIRP) of 56 dBm per MHz within the Spectrum Band.	
Interference to and from other spectrum users	Licensees will have to adhere to a technology and application neutral block edge mask (see section 6 and Annex C). An out-of-block limit for unwanted emissions of -126 dBm per 100 kHz is proposed.  Prospective licensees should note the possibility of interference to and from other spectrum users. As guidance, the technical characteristics of the current adjacent spectrum band uses is given in Annex C.	
International coordination obligations	ComReg and Ofcom will have a role in the process of international frequency coordination.  The requirement for coordination is discussed in section 4 and Annex C.	
Licence term	In Ireland the licence will have a minimum term of 15 years with a review of the licence period within 3 years of the expiry date.	In Northern Ireland the licence will have an indefinite term with a minimum term of 15 years, subject to 5 years notice of revocation after that period for spectrum management purposes, which could lead to the licence being terminated the day after the expiry of the 15 year minimum term or any time thereafter.

<sup>1</sup> Ireland is used in this document to refer to the 26 Counties of the Republic of Ireland.

	<b>Ireland</b>	<b>Northern Ireland</b>
Licence fees	<p>The auctions will determine the fees payable for each licence in each jurisdiction.</p> <p>In Northern Ireland, if the licensee continues to hold the licence beyond the minimum term of 15 years, there may be additional charges in line with UK policies for spectrum pricing at that time.</p>	
Spectrum trading	The licence(s) will not be tradable.	All rights and obligations arising under the licence will be tradable from the date of award.
Site information databases	Licencees in Ireland may be required to provide information for inclusion on the Siteviewer database	Sitefinder is a national database of mobile phone base stations which Ofcom administers on behalf of the UK Government. The UK Government would like to invite all licensees in the Spectrum Band if they use one of the technologies covered by Sitefinder to provide relevant information on a voluntary basis. See Annex D for details.
<b>Award mechanisms and Rules</b> (See also section 8 and Annex E)		
Basic auction format	A sealed bid auction format is proposed for both awards.	
Sequence for auctions	The auctions will be held in quick succession. The auction in Ireland will be first in the sequence. The auction in Northern Ireland will follow.	
Determining the successful bidders	In each jurisdiction, the winning bid for each licence in each auction will be the highest bid. In the event of a tie lots will be drawn to determine the winning bid.	
Payment terms	Winning bidders will be required to pay 100% of the fee before each licence is issued.	
Pricing rule	In each jurisdiction, and for each licence auctioned separately, the winning bidder will pay the second price bid for that licence.	
Transparency	There will be a registration process for participation in the auctions, and the identities of all those registered will be made public.	

	Ireland	Northern Ireland
Prohibitions on bidder association and collusion	There will be specific rules to prohibit collusion.	
Reserve prices	<p>Two reserve prices will be set, one for the licence awarded by ComReg and one for the licence to be awarded by Ofcom.</p> <p>The reserve price for the Ireland licence will be €150,000                      The reserve price for the Northern Ireland licence will be £50,000</p>	
Deposits	In each jurisdiction, bidders will be required to submit a cash deposit with their bid. The level of the deposit will be set at 50% of the amount.	
Un-sold licences	If after the auction one or both licences remain unsold, ComReg and Ofcom will each determine how to proceed in the light of circumstances at that time.	

*Q.1 Do stakeholders agree with these proposals for the award of this band or have any other comments on the contents of this document?*

## Next Steps

- 2.8 ComReg and Ofcom welcome comments on these proposals from interested parties. The consultation closes on 2 March 2006.
- 2.9 The method for responding to this consultation is given at Annex A. You may respond either to ComReg or Ofcom. ComReg and Ofcom expect to share the responses received by each administration, so that proposals for the award can continue to be developed in a co-ordinated way.
- 2.10 Prior to the close of the consultation, ComReg and Ofcom plan to hold joint seminars on the proposals for interested parties in Belfast and Dublin.
- 2.11 Subject to the outcome of this consultation, ComReg and Ofcom propose holding the auctions for wireless telegraphy licences to use the Spectrum Band in 2006.



- 2.12 After considering the responses to this consultation, ComReg and Ofcom will publish a joint response and then may publish information memoranda describing in detail the relevant information for the separate awards such as the procedures and rules, licence conditions and other information for each jurisdiction likely to affect the use of the Spectrum Band.
- 2.13 Before any auction is held:
- ComReg will publish and consult on draft regulations prescribing inter alia the terms and conditions of the licence in Ireland in accordance with Section 6 of the Wireless Telegraphy Acts 1926 to 1988, as amended; and
  - Ofcom will publish and consult on draft UK regulations setting out the auction rules for the Northern Ireland licence.
- 2.14 ComReg and Ofcom expect to hold further “question and answer” sessions on the auction rules, in particular to ensure that bidders understand the processes.

## Section 3

# Introduction

### Shared aim

3.1 The border between Ireland and Northern Ireland raises some specific telecommunications and spectrum issues for consumers and businesses. In April 2004 ComReg Commissioners John Doherty and Isolde Goggin met with Stephen Carter, Chief Executive of Ofcom in London with the aim of seeking solutions that would be both market-driven and in the best interests of citizens and consumers in both jurisdictions. The aim of this consultation is to obtain views on the award of spectrum licences in a market-driven and co-ordinated way. The proposals set out in this document offer the potential to create and develop wireless-based electronic communications services throughout the island of Ireland for the benefit of citizens and consumers in both jurisdictions.

### Shared objective

3.2 The objective of this award is to further the interests of citizens and consumers by promoting the optimal use of the electro-magnetic spectrum, in particular the Spectrum Band. In that regard ComReg's and Ofcom's shared desire is to facilitate the development of a co-ordinated use of spectrum in Ireland and Northern Ireland as such development may enable more efficient use of the Spectrum Band in both countries. In preparing proposals to secure this objective ComReg and Ofcom also expect to have regard, in particular, to the availability of, and demand for, the spectrum and to the desirability of promoting:

- the efficient management and use of the spectrum;
- the economic and other benefits that may arise from use of the spectrum;
- the development of innovative services; and
- competition in the provision of electronic communications services.

3.3 As Ireland and the UK are separate States operating under distinct legal frameworks, it is not feasible for either administration to award licences that have extra-territorial effect or to run a joint competition for a radio spectrum licence covering both Ireland and Northern Ireland. It is for these reasons that ComReg's and Ofcom's proposition is to develop separate competitions run under each State's legal framework, but reflecting the common objective of optimal usage of radio spectrum for the benefit of citizens and consumers across Ireland and Northern Ireland.

### Motivation for a co-ordinated approach to the awards

3.4 Availability and take-up of telecommunications services have grown rapidly throughout the island of Ireland in recent years as a result of developments in the market and regulatory environment in both jurisdictions. Further increase in choice, development of innovative services and deployment in less populated areas may result from more wireless spectrum being made available to the market.

3.5 Interference between wireless networks in neighbouring countries, and particularly along border regions, can present a barrier to the rollout of wireless services in areas that may also be underserved by other, non-wireless platforms. ComReg and Ofcom

are therefore proposing processes for the award of available spectrum at 1785–1805 MHz in a co-ordinated way in both jurisdictions. This will create an opportunity to reduce the difficulties imposed by radio interference between wireless networks and enhance the availability of services throughout the island of Ireland.

- 3.6 The excellent range and coverage available with the Spectrum Band makes it suitable for serving rural as well as urban areas. This factor, combined with the potential to provide service on both sides of the border could enable cost-effective provision of wireless-based electronic communications services to develop even in remote border areas and could enhance balanced regional development. The proposed award may also make it easier to provide seamless services to users who operate on both sides of the border.
- 3.7 Ofcom has carefully considered the merits of awarding a licence for Northern Ireland separately from Great Britain (see section 6 and Annex E). Ofcom believes that awarding a licence for Northern Ireland separately from Great Britain will benefit citizens and consumers because more spectrum will be made available in Northern Ireland sooner at the same frequencies as will be available in Ireland. This will give the opportunity for businesses to address a larger market. Overall the release of spectrum in Ireland and Northern Ireland in a co-ordinated way is expected to offer a net economic benefit when compared with a separate award in Ireland and later in the UK.

### **Document structure**

- 3.8 This document presents shared views, proposals and objectives. Only where necessary are ComReg's and Ofcom's views and proposals treated separately. The structure of the document is outlined below and joint sections are indicated.
- 3.9 The first part of this document provides a background to the proposals and includes:
- Section 4 – this is a factual description of the existing characteristics of the relevant frequencies and covers the details of band plans, existing uses of the bands and national and international constraints that define the technical background to the proposals.
  - Section 5 – reviews the markets, likely uses and demand for the spectrum licences in the light of the technical characteristics of the Spectrum Band.
  - Section 6 – this section describes the spectrum packaging proposals and the technical licence conditions including:
    - the potential for licence exemption;
    - appropriate numbers of licences;
    - proposals on necessary technical restrictions; and
    - the characteristics of adjacent spectrum uses, the specification of the spectrum block, power limitations and unwanted emissions limits.
  - Section 7 – sets out proposals for the other licence conditions and other rights and obligations. It covers:
    - non-technical licence terms;
    - trading rights; and

- o a discussion of other rights and obligations, and relevant considerations.
  - Section 8 – deals with the design of the auctions and their rules. It sets out the rationale for the proposed choice of design and the associated rules.
- 3.10 There are a number of accompanying annexes.
- Annex A - re-states the questions posed in this consultation document.
  - Annex B - sets out how to respond to this consultation either to ComReg or Ofcom. Note that Ofcom and ComReg expect to share responses received between them.
  - Annex C - provides additional detail of the radio-technical aspects of the award including information on key interference effects, models that can be used to determine the level of protection needed for other radio spectrum users, some examples of how different technologies and applications can change the amount of spectrum that can be used (the effective bandwidth) and the modelling that has been carried out regarding a co-ordination threshold level.
  - Annex D - is specific to Ofcom. This Annex sets out Ofcom's consultation principles and provides a summary of the relevant responses to the Spectrum Framework Review: Implementation Plan and Ofcom's comments on them. The Annex also provides further information on technical aspects relevant to the award, which are specific to the UK and includes a discussion on a Spectrum Quality Benchmark for Northern Ireland for the Spectrum Band, site clearance requirements and information on Ofcom's Sitefinder database.
  - Annex E is also specific to Ofcom. It gives the details of the Impact Assessment carried out by Ofcom. This includes a detailed discussion on the choice of auction design for this award.
  - Annex F contains information on the legal framework for the award and includes a reference to the Common European Framework. A separate section deals with how Ofcom carries out its obligations under the European Framework and relevant UK legislation and Ofcom's duties and functions.
  - Annex G contains Ofcom's draft licence.
  - Annex H provides a glossary of key technical terms.

## Section 4

# Technical background to the award

## Overview of the spectrum

- 4.1 This consultation set out proposals to offer the Spectrum Band for use in both Ireland and Northern Ireland on a technologically neutral basis. In this chapter, the spectrum under consideration is discussed and the current uses of the Spectrum Band both internationally and within UK and Ireland are set out.
- 4.2 The Spectrum Band is allocated in the International Telecommunication Union (ITU) Radio Regulations, Table of Frequency Allocations<sup>2</sup> to fixed and mobile radiocommunication services on a primary basis<sup>3</sup>. Provision is also made for public correspondence transmissions from aircraft<sup>4</sup>. Ireland and the UK, as Members of the ITU are bound to abide by the provisions of the Constitution and Convention and the Administrative Regulations in all telecommunication offices and stations established or operated by them which engage in international services or which are capable of causing harmful interference to radio services of other countries<sup>5</sup>. However, it is possible to offer services other than those to which the Spectrum Band is allocated<sup>6</sup>. Licensees who intend to offer services other than those to which the Spectrum Band is allocated may do so, but they shall not cause harmful interference to, and shall not claim protection from, harmful interference caused by stations operating in accordance with the provisions of the Radio Regulations.
- 4.3 At a regional level and in Europe, the band is allocated by the Conference of European Posts and Telecommunication Administrations (CEPT) differently in two sub-bands. However, the CEPT allocations are not binding on Member States of the European Union. The band 1785-1800 MHz is allocated to fixed and mobile services on a primary basis<sup>7</sup> and the band 1800–1805 MHz is allocated to fixed service on a secondary basis and to mobile services on a primary basis. The 1800–1805 MHz band had, until recently, been the air-to-ground band for the pan-European Terrestrial Flight Telephone Systems (TFTS). However, TFTS failed as a commercial service and the harmonisation measures have been withdrawn. The CEPT Electronic Communications Committee (ECC) is considering whether to propose further harmonisation measures. Progress in Europe over the future of the 1800–1805 MHz band is discussed in more detail below.
- 4.4 The CEPT had allocated the band 1800–1805 MHz paired with the band 1670-1675 MHz across Europe for TFTS. Now that spectrum harmonisation measures for TFTS have been withdrawn in Europe, there is an opportunity to award the band 1800-1805 MHz for new services and some new licences have already been issued in

<sup>2</sup> Table of Allocations, Article 5 of the ITU Radio Regulations.

<sup>3</sup> Definitions for fixed and mobile services are given in the ITU Radio Regulations, Article 1, provision numbers 1.20 and 1.24 respectively. A primary allocation has the status and meaning specified by the ITU Radio Regulations, Article 5, provision numbers 5.23 – 5.33.

<sup>4</sup> Footnote No. 5.380 of the ITU Radio Regulations. This provision, which had been the international regulatory basis for the former Europe-wide system Terrestrial Flight Telecommunications Systems (TFTS), may be suppressed at the next World Radio Conference (WRC-2007)

<sup>5</sup> Constitution and Convention of the International Telecommunication Union, Execution of the Instruments of the Union, Article 6 (37),

<sup>6</sup> ITU Radio Regulations, Assignment and use of frequencies, General rules, Article 4.4

<sup>7</sup> Please refer to the European Table of Frequency Allocations and Utilisations Covering the Frequency range 9 kHz to 275 GHz at <http://www.ero.dk/doc98/official/pdf/ERCRep025.pdf>

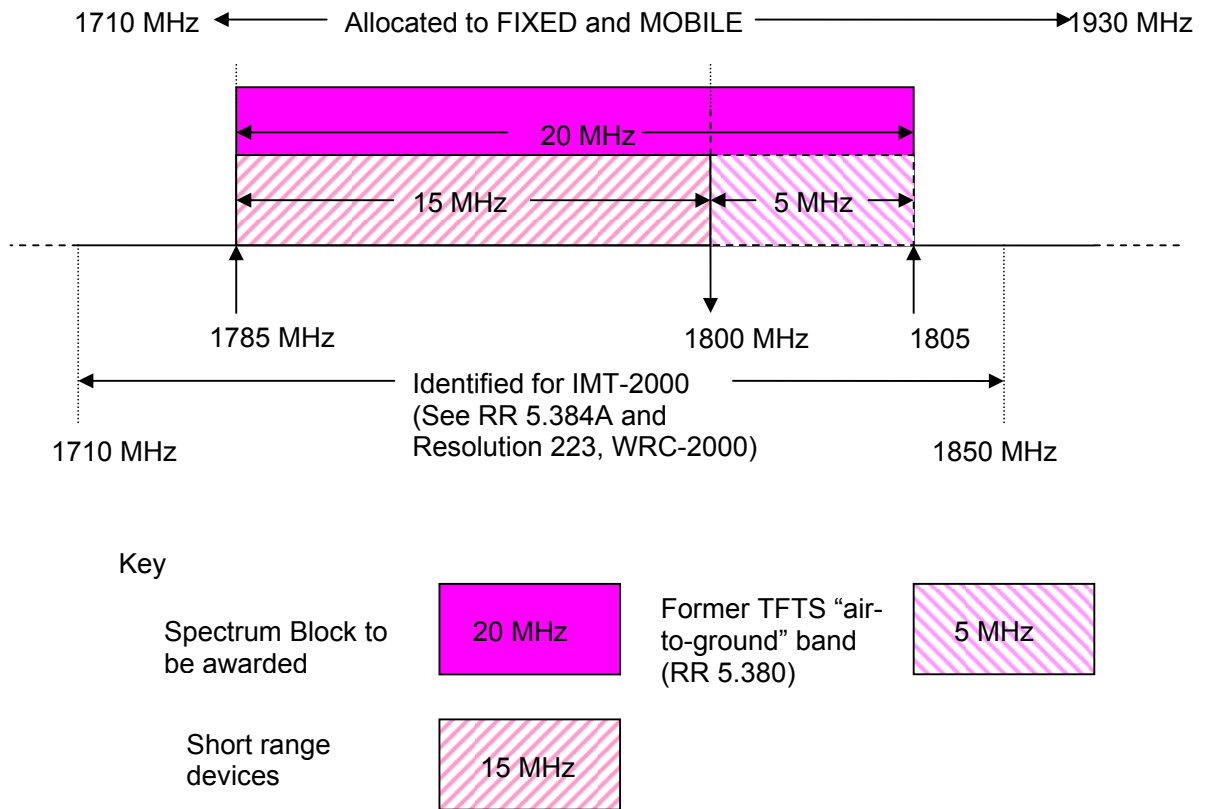
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some CEPT jurisdictions. The lower TFTS band 1670-1675 MHz has already been allocated to Mobile Satellite Services and is not discussed further here.

- 4.5 There is currently no consensus between European administrations in CEPT on the future use of the band 1800-1805 MHz or whether further harmonisation measures are justified. The UK's position is to seek the maximum flexibility in relation to future use of the frequencies. The European Commission (the Commission) has mandated the CEPT to study this matter in detail. The Commission has also proposed consideration of the band for licence-exempt use to encourage new innovative technologies while CEPT looked at possible specific uses.
- 4.6 ComReg and Ofcom do not consider that the current discussions in relation to possible further harmonisation measures concerning 1800-1805 MHz should prevent the award proposed in this document from proceeding. ComReg and Ofcom would expect any future harmonisation measure to take into account existing assignments in this band (including others made recently, on a technology neutral basis, by other European jurisdictions). Moreover, ComReg and Ofcom consider that it is reasonable to suppose, on the basis of currently available information, that any future harmonisation measure would give administrations the flexibility to continue awarding licences that are technology and service neutral to the maximum extent possible. Ofcom and ComReg are therefore minded to proceed with the proposal to award licences that include 1800-1805 MHz. The alternatives, of delaying the award process in relation to the entirety of 1785-1805 MHz, or specifically in relation to 1800-1805 MHz, are not attractive, not least given that the timescale for any further harmonisation measure is unclear, and there may indeed be no such outcome.
- 4.7 The CEPT ECC European Table of Frequency Allocations and Utilisations identifies, in addition to allocating the band for fixed and mobile services, potential radio microphone use in the band 1785–1800 MHz<sup>8</sup>. Details of this use can be found in the CEPT Recommendation on Short Range Devices (Recommendation 70-03), which while not binding on Member States of the European Union, also identifies the band 1795-1800 MHz for cordless audio applications (wireless connection of domestic sound systems). However, radio microphone use of the band has been slow to develop and the ECC is looking to see whether the use of the band for short range devices can be made more generic.
- 4.8 Figure 4.1 below shows the Spectrum Band, the international allocations for 1710-1930 MHz, the band used by short range devices and national uses of the spectrum. In the UK, the paired bands 1781.7–1785 MHz and 1876.7-1880 MHz (the “DECT guard bands”) are subject to an ongoing Ofcom award procedure. Details of this can be found at: <http://www.ofcom.org.uk/consult/condocs/1781/>.

<sup>8</sup> CEPT Electronic Communications Committee Recommendation ERC/REC. 70-03.

**Figure 4.1 The Spectrum Band**



4.9 The lower band edge at 1785 MHz is close to the GSM 1800 (mobile transmit, base station receive), which is in the band 1710–1785 MHz. The upper band edge at 1805 MHz is adjacent to the GSM 1800 (mobile receive, base station transmit) band at 1805–1880 MHz. The first GSM base transmit carrier is centred on 1805.2 MHz.

### Short range uses of the spectrum

- 4.10 As mentioned in paragraph 4.7 above, use of the 1785-1800 MHz spectrum for low power, short range digital wireless microphones is provided on the basis of a recommendation adopted by the ECC<sup>9</sup>. This recommendation is not binding on the UK or Ireland. Though digital wireless microphone equipment capable of using the band has been slow to emerge, manufacturers treat such recommendations as a basis for standardising equipment and this may encourage the appearance of new devices in the market designed to use the Spectrum Band. The award of technology and application neutral licences must take account of the potential for this use.
- 4.11 In response to a Mandate from the Commission, CEPT is preparing a report on the effectiveness and flexibility of spectrum availability for short range devices. This is looking at both the use of existing short range device bands such as 1785-1800 MHz and the methods for providing spectrum for future short range device demand. One of the methods proposed for meeting this growing demand is to make the bands

<sup>9</sup> Recommendation - ERC/REC 70-03.

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more generic so that both analogue and digital wireless microphones and other short range devices could use the spectrum. This could have the effect of increasing short range device use in this band as these devices are designed for free circulation across the European Community.

- 4.12 The proposals for the award envisage that the Spectrum Band will be technology and application neutral. In Northern Ireland this will allow radio microphone and other short range device users to compete for the licence or subsequently acquire access to the spectrum (for example through spectrum trading) provided that a mechanism for managing the Spectrum Band for users of these technologies exists. The potential for organisations to act as Band Managers (spectrum management organisations) has been considered by Ofcom. This matter is discussed further in section 7.
- 4.13 In Ireland it is permitted to use the band 1785.7–1799.4 MHz for radio microphones on a licence exempt, non-interference and un-protected basis. The band 1795–1800 MHz is being considered for use by wireless audio devices on a licence exempt, non-interference and un-protected basis. Full details of the conditions of use associated with wireless microphones in this frequency band can be found in ComReg document 02/71 on the ComReg web-page ([www.comreg.ie](http://www.comreg.ie)).
- 4.14 It is proposed that in both Ireland and Northern Ireland the current designation for use of the band by digital radio microphones and wireless audio devices on a licence exempt basis will be withdrawn. The reasons for this proposal are as follows:
- it allows licensed use of the Spectrum Band without having to co-exist with licence exempt use, i.e. in order to allow the proposals in this document to proceed;
  - it reflects the lack of development of digital radio microphones in the band; and
  - it does not prevent use of the frequencies for radio microphones in the future, on a licensed basis, if this turns out to be an efficient use of some or all of the spectrum.

*Q.2 What are your views on the proposal to discontinue the use of the 1785-1800 MHz band by radio microphones and 1795-1800 MHz by wireless audio devices on a licence exempt basis?*

## Other uses of the spectrum in the UK

- 4.15 In Great Britain, there is some military use of the spectrum of which potential licensees should be aware. More details of this are given in Annex D.

## A Spectrum Quality Benchmark for Northern Ireland

- 4.16 A Spectrum Quality Benchmark (SQB) is used by Ofcom to denote the level of spectrum quality on which technical planning and coordination processes and criteria are based. An SQB for Northern Ireland is discussed in detail in Annex D.



## Section 5

# Possible uses of the Spectrum Band

- 5.1 In this section the likely uses and demand for the Spectrum Band are discussed in the light of the technical characteristics set out in section 4 above and in Annex C, The reason for assessing the likely uses of the Spectrum Band is not to determine what use may be made of it, but to inform the proposals for spectrum packaging and further aspects of the award, so that they facilitate likely use and hence promote a more efficient primary assignment process.
- 5.2 The information given in this section is intended to inform the award processes. It is not intended to form any part of the basis for any investment decision or other evaluation or any decision to participate in the auctions and should not be considered as a recommendation by ComReg and Ofcom to anyone considering whether or not to participate in the auctions. Before considering whether or not to participate in the auctions, interested parties should conduct their own due diligence.
- 5.3 In preparing proposals for this award ComReg and Ofcom have drawn on an evaluation of potential uses carried out by Quotient Associates on behalf of ComReg and Ofcom.

### Benefits of co-ordinated awards

- 5.4 The co-ordinated award of spectrum licences in both jurisdictions may create economies of scale for operators planning to serve customers across the island of Ireland. This may boost the viability of the business case for offering services using these frequencies, and eventually benefit citizens and consumers.
- 5.5 A number of effects could give rise to enhanced economies of scale. These include the possibility of lower deployment costs given higher equipment volumes from larger markets. There is also an important effect associated with co-ordinated spectrum use in the border area between Ireland and Northern Ireland. In the absence of co-ordination it may be difficult for licensees respectively in Ireland and Northern Ireland to access the border areas, particularly if different licensees each deploy different and incompatible technologies. The exclusion zone (i.e. the physical separation between transmitting stations and receiving stations necessary for their normal operation) that could be created by the deployment of two different and incompatible wireless technologies under separate spectrum licences may be substantial. This issue is explored in detail in Annex C.
- 5.6 The ability to deploy one network and co-ordinate the use of the Spectrum Band throughout the island of Ireland may allow the border area market to be added to the overall business case. This is likely to increase the overall value of holding licences in both territories. These considerations underpin ComReg's and Ofcom's view that there is merit in co-ordinated award processes.
- 5.7 Where licences are held by the same economic entity in both territories, it may also be possible to avoid duplication of some operational costs.

### Attractiveness of the spectrum – Market implications

- 5.8 As discussed in section 4, the Spectrum Band is not internationally harmonised to any material extent except for radio microphones, and in relation to radio

microphones no equipment has been developed that is yet available to the market. This suggests that if effective use is to be made of the frequencies, it will be necessary for equipment vendors to manufacture equipment that can be used at this frequency.

- 5.9 There are typically cost implications associated with 're-banding' equipment (re-designing and/or re-building equipment originally designed to use a different band).
- 5.10 The Spectrum Band, while not harmonised, is intrinsically of "good quality". It is located near the centre of the 1-3 GHz frequency range, which is already heavily used for a vast range of applications because of the excellent propagation characteristics, effective bandwidth and freedom from long-distance (e.g. trans-continental) interference. The radio propagation characteristics of the Spectrum Band also lend themselves to the deployment of wireless networks that benefit from non-line of sight propagation. The demand for spectrum in the 1-3 GHz range, as evidenced by previous spectrum awards throughout Europe, has been high and reflects the intrinsic value that spectrum in this frequency range exhibits for a very wide range of uses and applications.
- 5.11 The evidence available to ComReg and Ofcom suggests that there are differing attitudes among equipment manufacturers towards their willingness to develop equipment for the Spectrum Band. Those manufacturers aiming for mass market and multi-vendor inter-operability generally seek access to spectrum for which equipment standards are harmonised. Without economies of scale from such harmonisation, operators might need to purchase equipment at volumes commensurate with an extensive network rollout. However, some technology vendors could be more flexible and favour releasing this Spectrum Band even where equipment standardisation makes the deployment of the equipment possible only in a few countries. Manufacturers and vendors of this type of equipment might be expected to seek high spectrum efficiency and a narrow market focus to enable this relatively small spectrum band to be utilised effectively.

### **Possible uses of the Spectrum Band**

- 5.12 A number of possible uses of the Spectrum Band have been identified and these are outlined below. However, it is possible that there may be other uses that have not been identified.

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

- 5.13 The frequency band could be used by services that support the broadcasting and entertainment industry such as:
- digital wireless microphones and
  - digital video links.

### **Digital wireless microphones**

- 5.14 Digital wireless microphone equipment has yet to emerge for the band 1785-1800 MHz and there is evidence to suggest that this market will continue to use analogue microphones until demand for digital technologies increases. There are difficulties with designing digital wireless microphones for the Spectrum Band, and while these remain, it is likely that most development effort will be directed towards spectrum in

the UHF range, which enjoys propagation characteristics that are more suitable to this type of service than higher frequencies.

### **Digital video links**

- 5.15 Digital video links currently use frequencies in the 2.2 to 2.4 GHz range. Evidence suggests that this is a frequency range that is becoming congested. The typical bandwidth of a digital video path is 8 MHz, which the Spectrum Band might be able to accommodate subject to more thorough calculation of the bandwidth available for services once requirements to protect adjacent services is taken into account.

### **Closed Circuit Television (CCTV)**

- 5.16 There is evidence of an increasing demand for wide area CCTV surveillance in urban areas and that this is prompting increased use of wireless CCTV outdoors where the use of wireless technologies has a number of benefits for this application including:
- cameras do not require installation of video cable allowing faster deployment;
  - deployment in difficult locations is simplified; and
  - dynamic re-configuration is feasible.
- 5.17 If the use of wireless CCTV becomes widespread, increases in the levels of interference in the spectrum currently available at 2.4 GHz could adversely affect system performance and prompt consideration of other frequency bands for this application.

### **Mobile technologies**

- 5.18 The Spectrum Band could potentially be used to supplement mobile services in a number of ways such as supplementing network capacity for delivery of mobile services and facilitating rollout of new mobile broadcast services.
- 5.19 The market interest in new mobile broadcast services (e.g. mobile TV) is increasing as evidenced by the numerous trials happening across Europe, the US and Asia and the launch of satellite/terrestrial mobile TV services (using DMB) in Asia. Mobile video services are also being offered on a subscription basis over existing mobile networks.

### **Fixed links**

- 5.20 Spectrum for fixed links is usually available on demand. However, there may be demand for low capacity links (such as backhaul from WiFi hotspots or connections to small business) in the Spectrum Band. There is some evidence that these low capacity links could be more effectively catered for by a service based on the use of Broadband Wireless Access technologies.

### **Broadband Wireless Access (BWA) market segments**

#### **Broadband for residential users**

- 5.21 Two issues have been identified associated with BWA use of the Spectrum Band to serve residential users. These are the ability to deliver the high capacity demanded by residential users and the ability to increase the service access speeds to remain competitive with increasing throughput offered by other technologies (such as those

based on ADSL). The band is limited by the size of the carriers that can be deployed once guard bands to protect adjacent band services are taken into account.

### **Broadband for business users**

- 5.22 The provision of broadband access for business can be less demanding of spectrum on a per user basis. Business users may have less use of entertainment based applications such as music and video streaming than residential users. However, broadband fixed connections may be shared by a number of employees.
- 5.23 Many business users also need mobility as an intrinsic part of their work function and for these users the provision of high bandwidth mobile communications can improve the efficiency or effectiveness of their work. Examples might include field maintenance and sales personnel (for access to large data files and images), construction site personnel (where on site communications do not initially exist) and remote monitoring (security alarms and cameras). Public sector users might include local government and education. Mobile sectors might include emergency services (for transmission of on site images) and advertising (for example for dynamic contextual control of advertising plasma screens on public transport).

### **Other service segments**

- 5.24 BWA systems can offer a high capacity connection that can be used to support other systems such as CCTV networks and backhaul for other operators (such as WiFi hotspots). This suggests that the Spectrum Band could be suited to supporting CCTV systems where their operation is triggered by alarms so that the use is occasional rather than continuous. WiFi hotspots supporting a large number of users and having a high degree of averaging will tend to limit access speeds for other business users.

### **Spectrum requirements for networks**

- 5.25 Important aspects of network planning are the minimum amount of spectrum required to deploy a practical network, and the minimum spectrum required to support capacity enhancement or higher service levels. The spectrum required to deploy networks varies depending upon their access mechanism and channel structure. Minimum spectrum requirements for some technologies are discussed in Table 5.1 below. These figures for minimum spectrum requirements are intended only as examples of what might be possible.

**Table 5.1 Example spectrum requirements for network deployment**

Technology	Minimum Spectrum and Service level	Higher service level options
UTRA TDD	Network can be deployed using a single 5MHz carrier. This will enable 1 Mbit/s at the cell boundary.	If 10 MHz were available then a single 10 MHz carrier could be deployed. This would enable 2 Mbit/s at the cell boundary.
WiMAX	Carrier spacing is variable, but 3 cell re-use is typically required. A 1.75 MHz carrier could support a bit-rate of 0.37 to 3.2 Mbits/s depending on modulation and coding scheme.	The narrow channel spacing allows spectrum between 5 and 10 MHz to be used, either by higher bandwidth or more carriers.
HC-SDMA9 (iBurst)	Network is deployed using carriers of 625 kHz. To achieve network efficiency with 1Mbit/s minimum rate, 5 MHz is required.	The equipment is configured in units of 5 MHz, therefore 10 MHz is required to increase capacity and deliver a minimum bit rate of 2 Mbits/s.

**Conclusion**

- 5.26 This section has identified that there is a wide range of possible alternative uses for the Spectrum Band. The effective spectrum available for new services (once the protection needed for other spectrum users in the adjacent and near-adjacent spectrum is taken into account) and the fact that the Spectrum Band is un-paired, suggests that new broadband wireless applications using TDD technologies may be able to make efficient use of it.
- 5.27 Not all possible alternative uses for the Spectrum Band are mutually exclusive depending on location. It may be possible for different uses and users to co-exist under some circumstances (e.g. BWA in rural areas and radio microphones in city centres).

## Section 6

# Spectrum packaging and technical licence conditions

## Choice of assignment mechanism

6.1 In this section the choice of assignment mechanisms for spectrum and the geographical scope of packaging are considered. Three types of assignment mechanism are identified: licence exemption, licensing with no limit on the number of licensees and limiting the number of licences to be awarded. A further option is whether the spectrum should be left un-assigned.

## Licence exemption

- 6.2 ComReg and Ofcom have considered whether it would be likely to promote optimal use of the spectrum to make the Spectrum Band available by means of licence exemption. Ofcom has also considered its duty (under section 1AA of the Wireless Telegraphy Act 1949. See Annex F) to make regulations exempting from the requirement to be in accordance with a licence the establishment, installation and use of any station or apparatus, where such use is not likely to involve undue interference with wireless telegraphy.
- 6.3 The potential uses of the Spectrum Band include BWA, mobile technologies, PMSE uses, CCTV and fixed links. These are discussed in section 5 above.
- 6.4 The PMSE sector includes short range applications and new short range devices have been identified that might use the Spectrum Band. While the alternative uses for the Spectrum Band may not be mutually exclusive depending on location, if all the possible uses were permitted in the Spectrum Band on a licence exempt basis the likely result would be significant interference in a number of locations. Services like the professional use of wireless microphones might feasibly be offered where engineering coordination amongst service providers is possible, as operators would then be able to mitigate the interference. The complexities of cross-border coordination suggests that engineering coordination amongst service providers might only be feasible under a band management arrangement. Band management is discussed in section 7.
- 6.5 Without band management, coordination between users is likely to be problematic as little or no information would be available about the identity of other users. Even if users could identify each other, engineering coordination might involve large numbers of users and be frustrated by bargaining inefficiencies and high transaction costs. This is because, in the case of licence exemption, there is no restriction on who can operate licence-exempt equipment and this is likely to involve large numbers of both companies and members of the public.
- 6.6 Moreover, a licence exempt approach is not likely to offer sufficient protection for service providers in relation to the likelihood of interference particularly in the residential environment where short range devices and licensed services might be co-located (for example, co-frequency, co-located BWA and home entertainment systems using short range wireless audio applications).

6.7 A licence exempt approach to the use of the Spectrum Band would therefore be likely to involve undue interference and would be likely to lead to less than optimal use of the Spectrum Band. Licence exemption is not appropriate for high power transmitters using this Spectrum Band without appropriate mitigating restrictions on spectrum use (e.g. the use of narrow-beam antennas and geographical exclusions). ComReg and Ofcom therefore consider that licence exemption would not provide a satisfactory basis for managing the Spectrum Band.

### **Number of licences**

6.8 The number of licences to be awarded should be considered in terms of a range of considerations, against the overall objective of the award of securing optimal use of the spectrum, e.g.

- economic viability of service offerings;
- facilitating engineering co-ordination, including cross-border management of the spectrum;
- simplicity and effectiveness of the award process; and
- any competition considerations.

6.9 The requirements for engineering coordination, particularly across the border, suggest that the number of licences issued should be such as to make engineering coordination readily feasible. The issue of the number of licences to be awarded in each territory also needs to be considered in terms of technical restrictions, service capability, business performance and demand from potential bidders.

6.10 Multiple licence options may be technically feasible. These licence options include:

- in Northern Ireland, two networks each based on 3 x 1.25 MHz carriers.;
- in Ireland, two networks of 5 MHz each or 2 networks of 5.25 MHz (3 x 1.75 MHz) each.

### **Licensing without limit on numbers**

6.11 In principle, it would be possible to license use of the Spectrum Band, but without imposing a limit on the number of licensees (e.g. a 'light licensing' regime). This would provide a mechanism for capturing information as to the identity of users, thereby creating a basis for engineering coordination. However, an approach on these lines would not be sufficient to ensure effective engineering coordination between the licensees and, in the absence of a robust engineering coordination mechanism, it is considered that a high risk of inefficient use of the Spectrum Band would remain.

6.12 In the absence of any limit on the number of licences, the number of licensed users of the Spectrum Band could be high. Any one of these licensed users might fail to coordinate effectively with others, imposing significant costs on those other users. Also, costs of transacting and bargaining with other users could be high, frustrating efficiently co-ordinated use. If there is no limit on the number of licences, the incentives to coordinate are likely to be insufficient and the costs of engineering coordination are likely to be too great to promote the optimal use of the spectrum. This supports the argument for a limit to the number of licences that should be awarded.



## **Award of available spectrum: 1785 - 1805 MHz**

- 6.13 It would in principle be possible to auction blocks of spectrum and let the channel pattern be determined by the auction outcome. However, this would considerably increase the complexity of the auction design and process of award and the risk of an inefficient outcome. In Northern Ireland however, if the licence was awarded to a person enabled to act as a Band Manager (as described in section 7 below), the Band Managers could to disaggregate use of the spectrum. So the award of a single licence would not preclude sharing by multiple users.
- 6.14 ComReg and Ofcom are not aware of any demand for the assignment of licences that are regional in character (i.e. multiple geographical licences in either Ireland or Northern Ireland). ComReg and Ofcom also consider that splitting the Spectrum Band by geography or by frequency is likely to be undesirable as it is likely to impose additional constraints on the flexibility of use for licensees: each boundary (in frequency or space) will require additional boundary conditions to be determined, which will increase complexity and reduce flexibility.

## **Maintaining the spectrum unassigned**

- 6.15 A further option is to do nothing with the spectrum. This option would delay the spectrum being used for productive purposes for many years resulting in a loss to the economies of both countries.

## **Geographical scope**

- 6.16 There are various options for packaging the rights of use under the wireless telegraphy licences, each of which has advantages and disadvantages. The options for packaging could differ in terms of the number of consumers that may access the service, the cost of services, the timing of delivery to consumers and service functionality. These differences and the effects they may have are explored further in Annex E.
- 6.17 In this section we summarise the relative economic benefits of the following packaging options:
- co-ordinated award across Ireland and Northern Ireland: co-ordinated award of licences in Ireland and Northern Ireland in 2006 followed by award in Great Britain during 2007/08;
  - all-UK: Ireland award in 2006 and a later all-UK award in 2007/08;
  - separate and un-coordinated awards in Ireland and Northern Ireland: three separate awards are assumed to be made as follows: in Ireland in 2006, Northern Ireland in 2006 and Great Britain in 2007/08.
- 6.18 Differences in the economic benefits from the geographical packaging options can occur because:
- the number of consumers that may access the service arise under the co-ordinated award outcome (relative to the separate awards option) will be different;
  - the co-ordinated award process means that consumers in the border areas can be served by a single operator offering a new service and costs of supply could differ between the options as a result of differences in the costs of procuring network equipment; and
  - delays in service provision only affect those services provided in Northern Ireland and under the co-ordinated award option, roaming may be facilitated for consumers in the north and south of Ireland; may gain the benefits of roaming while under the



all UK option consumers in Northern Ireland might find it easier to roam to the rest of the UK (and vice versa), though not until later.

### Summary of options

6.19 Table 6.1 below summarises the various options and gives a qualitative indication of their scale. Overall we believe that the co-ordinated award outcome offers a potential net economic benefit as compared with the other two options considered. The benefit relative to the separate awards option arises from the potential synergies in offering a service across Ireland, and the benefit relative to the all-UK option arises from the increased consumer choice in Northern Ireland in the period 2006-2009/10.

**Table 6.1 Summary of packaging options**

	<b>co-ordinated award vs separate awards</b>	<b>All-UK vs separate awards</b>
Benefits	Consumer benefits of increased choice. Lower costs for service provision in Northern Ireland. Small potential roaming benefit.	Possibly lower costs in Northern Ireland, though delays in award could mean the service may not be provided. Small (if any) roaming benefit.
Costs	None	Reduction in consumer benefits due to delay of choice of services in Northern Ireland

### Conclusion on the number of licences

- 6.20 In the absence of any limit on the number of licences, effective engineering co-ordination between the licensees would not be robust. In the absence of a robust engineering co-ordination mechanism, it is considered that a high risk of inefficient use of the Spectrum Band remains. Also, the costs of transacting and bargaining with other users could be high, frustrating efficiently co-ordinated use of the Spectrum Band. The incentives to co-ordinate are likely to be insufficient and the costs of engineering co-ordination are likely to be too great to promote the optimal use of the spectrum. This supports the argument for a limit on the number of licences that should be awarded.
- 6.21 It would in principle be possible to auction blocks of spectrum and let the channel pattern be determined by the auction outcome. However, this would considerably increase the complexity of the auction design and process of award and the risk of an inefficient outcome, given the range of potential uses for the Spectrum Band.
- 6.22 Offering multiple licences by geography or by frequency is likely to be undesirable as it is likely to impose additional constraints on the flexibility of use for licensees: each boundary (in frequency or space) will require additional boundary conditions to be determined, which will increase complexity and reduce flexibility.
- 6.23 It is concluded that a limit to the number of licences is appropriate. It is proposed that the number of licences is limited to one for Ireland and one for Northern Ireland.

Q3 *What are your views on the proposal to limit the number of licences to one for Ireland and one for Northern Ireland?*

### How much spectrum

- 6.24 In the band from 1785-1805 MHz, a total of 20 MHz of un-paired spectrum is available for award in both jurisdictions. Section 4.9 above identifies the adjacent band use of the spectrum.

### Effective spectrum within the Spectrum Band

- 6.25 The amount of effective bandwidth spectrum depends upon the technology deployed within the Spectrum Band and the protection requirements for services using adjacent spectrum. The Spectrum Band is an un-paired 20 MHz of spectrum. Although Frequency Division Duplex (FDD) is technically possible using this band, the engineering of a duplex filter that would leave sufficient effective spectrum (see Annex C) for the deployment of new services may be difficult. However, neither ComReg nor Ofcom has identified a justification for restricting the use of the Spectrum Band as adequate protection can be provided to and a technology neutral approach is likely to be beneficial in terms of promoting optimal use of the Spectrum Band. Subject to the limits proposed for maximum EIRP for individual emissions and those for unwanted emissions, licensees will therefore be free to establish the parameters of equipment for use within the Spectrum Band.

### Paired spectrum

- 6.26 It may be possible to pair the 1.7 GHz band with some spectrum elsewhere, for example the 2010 -2025 MHz band although the uplink and downlink bands would be reversed from the more usual paired configuration. The duplex spacing with this pairing of 225 MHz would be only slightly larger than the duplex spacing of Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access Frequency Division Duplex (UTRA FDD) and it represents one option recently considered by the CEPT in its discussions on the future of the 2010-2025 MHz band. However, the favoured option within the CEPT's ECC Project Team 1 on IMT-2000 and Systems Beyond is to redefine 1900-1920 MHz and 2010-2025 MHz as Time Division Duplex (TDD) or FDD uplink spectrum. This coupled with the potential use of the band 2570-2620 MHz as TDD or FDD for a downlink band gives the opportunity to use a combination of TDD bands to deploy future FDD networks.
- 6.27 Other spectrum, for example at 2302-2310 MHz is not likely to become available in Northern Ireland until 2007/08 for the reasons given in Ofcom's SFR:IP Interim Statement (see paragraphs 4.52 to 4.54).

### Spectrum channel arrangements

- 6.28 The traditional approach to spectrum assignment and packaging at a national level is to make the assignments based on radiocommunication service allocations and the International Table of Frequency Allocations of the ITU and the CEPT ECC European table of Frequency Allocations and Utilisations. Recommendations of the ITU-R dealing with technologies often also determine the channel arrangements that can be used. The use of specific channel arrangements eases the technical burden of coordination because the identification of preferred and non-preferred channels by administrations is simplified, but it also locks in specific technological constraints, which may not be desirable.

- 6.29 In this award the technologically neutral approach to be adopted makes no assumptions about channel arrangements. These will be flexible, and adjustable by the operator to suit the optimal use of the band.

### Technical conditions of the licences

- 6.30 This section analyses the technical conditions proposed and considers a power limit on in-band transmit power, a threshold field strength to trigger coordination, guard bands, the specification of a block edge spectrum mask and protection for other spectrum users. Details are also given of Spectrum Quality Benchmarks for Northern Ireland.

### Power limit and coordination threshold

- 6.31 The amount of usable spectrum depends upon the technology deployed within the Spectrum Band and the protection requirements for services using the adjacent spectrum. This is explored in Annex C. ComReg and Ofcom have carried out some technical studies to determine what measures might be required to mitigate the effects of interference to services in the adjacent band such as DECT/GSM1800. Based on these requirements and the simulations of the coordination impact associated with two typical maximum radiated power levels of 25 dBW and 32 dBW (see Annex C) it is proposed to set the maximum radiated power that may be used in the Spectrum Band at 56 dBm/MHz EIRP.

*Q.4 What are your views on the proposed limit of 56 dBm/MHz EIRP maximum radiated power that may be used in the Spectrum Band?*

- 6.32 For the purposes of coordination it is proposed that a field strength co-ordination threshold level will apply. The mechanism of coordination is discussed in section 4 and Annex C.

### Protection for other radio users

- 6.33 Licensees in the 1785-1805 MHz band will be required not to cause interference to neighbouring systems.

- 6.34 To assist in this regard, licensees must adhere to a technology neutral block edge mask as defined below. There are a number of ways in which a technology neutral block edge transmission mask can be determined, each of which will result in a different protection level for the adjacent band systems from any new system deployed in the Spectrum Band. Four ways to determine the protection level for the block edge mask for 1785-1805 MHz for adjacent band systems, which are discussed in detail in Annex C, are:

- protection level required as a result of DCS1800 receiver blocking by the new system;
- protection level required by DCS1800 as a result of interference from the out-of-band emissions of the new system;
- protection level equal to the DCS1800 noise floor minus 6dB; and
- protection level equal to the spurious emission level as defined in Appendix 3 of the ITU Radio Regulations.

**Award of available spectrum: 1785 - 1805 MHz**

- 6.35 It is proposed to apply a power spectral density level for unwanted emissions based on a calculation of the DCS 1800 receiver noise floor. Very low levels of noise will degrade the DCS 1800 service and noise levels resulting from co-channel interference are enhanced in major urban areas. Taking both effects into account it is proposed that the power level of unwanted emissions should not exceed -126 dBm/100 kHz.
- 6.36 It is proposed that unwanted emissions, which include out-of-band and spurious emissions, should be tightly controlled by specifying a block edge spectrum mask. The specification for this block edge mask is given below.

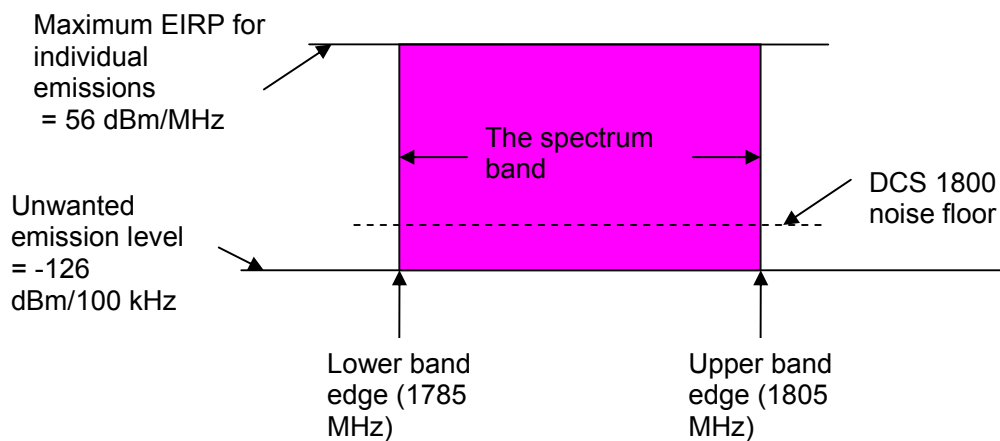
**Guard bands**

- 6.37 No guard bands will be used outside the Spectrum Band and licensees must meet the block edge mask. The limit of -126 dBm/100 kHz will apply to all unwanted emissions including spurious and out-of-band emissions. The limit on unwanted emissions into the adjacent band services is intended to be completely independent of technology used for the new service.

**Protection level for out-of-block emissions**

- 6.38 The protection level proposed is intended to ensure a technology neutral block edge transmission mask which will ensure an appropriate protection level for the adjacent band systems from any new system deployed in the Spectrum Band. This level is calculated at -126 dBm/100 kHz. See Annex C for more details.
- 6.39 In Northern Ireland, at the lower band edge, the licensee may, with the prior agreement of Ofcom, trade an increase in unwanted emissions for greater co-ordinated separation from the incumbent adjacent band operator.

**Figure 6.1 Specification for the block edge mask**



- 6.40 Under the conditions of technical and application neutrality proposed, licensees will be able to determine appropriate parameters within the Spectrum Band provided that services in adjacent spectrum are protected.

*Q.5 Do you think that the methods, limits and approach to a threshold for coordination proposed above are appropriate? If not, what measures do you think would be appropriate?*

## **Engineering co-ordination for interference management**

- 6.41 The award processes proposed allow for the possibility that separate networks could be deployed in Ireland and Northern Ireland using different technologies or providing different services. When networks are located close to one another, it is likely that interference will occur. International frequency co-ordination will be used to manage interference across the border.

## **International frequency co-ordination**

- 6.42 In the event that licences are acquired by different licensees in Ireland and Northern Ireland, they will be obliged to coordinate their use of spectrum with the other licensees in the Spectrum Band. The results from studies (see Annex C) indicate that the possibility exists for interference between systems deployed in the island of Ireland and those that may be deployed on the Isle of Man or the west coast of Great Britain. ComReg and Ofcom's role in the process of international frequency co-ordination is discussed below.
- 6.43 The requirement for frequency coordination will only apply to co-frequency use of the Spectrum Band. It will not apply to the management of interference with adjacent band services. The spectrum block specified above should ensure that the spectrum users in the adjacent bands are afforded the required level of protection from interference. However, if interference with neighbouring licence holders is reported, ComReg and Ofcom will expect licensees to co-operate with the neighbouring licence holders to resolve the issue.
- 6.44 Because the neighbouring DECT band is licence-exempt in Ireland and Northern Ireland, it will not be possible to co-ordinate users in that band and licensees in the Spectrum Band that is the subject of this award. However, it is not anticipated that interference issues between the two bands will be a problem.

## **Future assignments in the Spectrum Band**

- 6.45 There are no plans to offer other licences for the Spectrum Band except for those non-commercial licences intended to promote the development of and to trial new technologies (e.g. test and development licences in Ireland and non-operational licences in Northern Ireland).
- 6.46 Changes in the spectrum available for services may arise for a number of reasons, these include:
- Changes in spectrum allocations in accordance with the requirements of international treaties or regionally negotiated agreements;
  - Changes necessitated by EU legislation;
  - Changes in order to meet national requirements;
- 6.47 In the interests of the efficient use of the radio spectrum ComReg and Ofcom may review the use of the spectrum on an ongoing basis in order to reflect any changes, including those outlined above, and changes in the market place.

### Cross border co-ordination arrangement

- 6.48 Ireland and the UK are developing a cross-border co-ordination arrangement intended to deal with the Spectrum Band in the event that different uses and technologies are deployed. This arrangement is expected to be finalised by ComReg and Ofcom before the awards take place, but will be based on the principle of co-frequency use of the Spectrum Band. The agreement will specify a field strength at the border. This will be the threshold level that will trigger the requirement for co-ordination.

## Section 7

# Other rights and obligations

7.1 This section addresses licence conditions and various other rights and obligations of the licences. This includes the licence term and some matters specific to Northern Ireland.

### Licence term

7.2 The aim of the proposals on licence term is to provide licensees with a minimum period during which they would have high security of tenure, and grounds for revocation would be limited to a narrowly defined set of conditions. The period of the minimum term is linked to view of a reasonable period required to earn a return on the investment anticipated for efficient use of the spectrum. In Northern Ireland the proposal for a minimum term is consistent with Ofcom's practice in other bands. An indefinite licence creates an opportunity for the market to determine the most efficient use of the band without further regulatory intervention. After the minimum term both ComReg and Ofcom would be able to recover the spectrum in their jurisdiction by serving a notice of revocation, if this step was justified on spectrum management grounds.

7.3 In determining the length of the minimum term, ComReg and Ofcom have taken into account the period appropriate for the likely services and the need to provide a reasonable opportunity for likely businesses operating in the Spectrum Band to make a return on their investment.

7.4 ComReg's and Ofcom's proposals for licence terms are based on assessments of:

- initial fixed costs and operating costs to exploit the spectrum;
- the time likely to be needed to roll- out an operational service; and
- a reasonable estimate of the time that may be required to earn a return on investment.

7.5 An assessment of the business case has been undertaken using an estimate of enterprise value and Discounted Cash Flow (DCF) analysis. The market forecast that has been used is one based on the wholesale service provision model.

7.6 The major capital expenditure items are anticipated to be:

- site establishment;
- network and backhaul costs.

7.7 Operational expenditure includes annual equipment maintenance, site rental and business expenses such as marketing and administration.

7.8 The analysis suggests that If the minimum term of the licences is restricted to less than 10 years, it would introduce additional uncertainty and variation into bidders valuations. Our business case analysis shows that extending the minimum term beyond 10 years has potential to raise the value of the licence.

## Conclusion

7.9 Differences in the business cases for Ireland and Northern Ireland lead to different conclusions regarding the minimum term and different views on a reasonable period required to earn a return on the investment anticipated for efficient use of the spectrum. ComReg has concluded that a 10 year minimum term renewable for a further period of 5 years is appropriate. Ofcom has taken the view that the Northern Ireland licence should have an indefinite term with a minimum term of 15 years, subject to 5 years notice of revocation after that period for spectrum management purposes.

### Licence term in Ireland

7.10 ComReg proposes that the licence for Ireland would have a minimum term of 15 years with a review of the licence period within 3 years of the expiry date. Issues to be considered in the review may include whether the terms and conditions of the licence have been met, delivery of service and whether the spectrum is required for other services.

### Licence term in Northern Ireland

7.11 In Northern Ireland the licence will have an indefinite term with a minimum term of 15 years. During the minimum term the grounds for revocation by Ofcom would not include a general right to revoke for spectrum management reasons. After the end of the minimum term, the grounds for variation or revocation by Ofcom would be wider, and would include spectrum management reasons, provided that a minimum notice period of 5 years is given, which could lead to the licence being terminated the day after the expiry of the 15 year minimum term or any time thereafter.

7.12 During the minimum licence term in Northern Ireland the licence may only be revoked for the following reasons:

- with the consent of the licensee;
- for non-payment or late payment of the relevant licence fee;
- if there has been a breach of any of the terms of the licence;
- if the licensee has not complied with any requirement of any relevant trading regulations;
- in accordance with section 4(5) of the UK Wireless Telegraphy Act 1998. That section provides that notwithstanding any terms or provisions in a WT Act licence which restrict the exercise by Ofcom of its power to revoke licences, Ofcom may at any time, by notice in writing, revoke or vary licence terms if it appears to be requisite or necessary or expedient to do so in the interests of national security, or for the purposes of complying with a Community obligation of the UK or with any international agreement or arrangements to which the UK is party; and if it appears requisite or necessary or expedient to do so for the purpose of complying with a direction by the Secretary of State to Ofcom under section 5 or section 156 of the Communications Act 2003; and
- if the licensee has not complied with the auction regulations under which the licence was awarded.



## After the minimum term in Northern Ireland

- 7.13 In Northern Ireland once the minimum term has expired, the Licence will remain in force and continue to be held by the licensee indefinitely, subject to revocation of the licences on spectrum management grounds.
- 7.14 In Northern Ireland it is important to note that after the expiry of the period of the minimum term it is possible that Ofcom may apply an annual licence fee. Whether or not a fee is charged will depend on Ofcom's general approach to fees for the use of spectrum at that time and how that general approach relates to these licences. Such fees could be set at a level to recover a share of the costs of regulation; they may alternatively be based on Administrative Incentive Pricing (AIP) if this is appropriate in the context of Ofcom's statutory duties. AIP presently plays an important role as an incentive for efficient spectrum management in the UK and Ofcom has stated that it expects to continue applying AIP to complement spectrum trading in order to promote efficient use of the spectrum.
- 7.15 It is not considered necessary or appropriate to specify now the level of the annual licence fees in Northern Ireland, if any, that may be applied to the Spectrum Band after the end of the minimum term. Ofcom would expect to bring forward proposals on this matter to a timescale that gave licensees reasonable notice of any relevant fees before they became payable.
- 7.16 Ofcom considers that it is appropriate to include licence conditions allowing for the possibility of licence fees, and revocation on spectrum management grounds, after the minimum term because of the need for Ofcom to be able to intervene if required to promote efficient use of the spectrum. Ofcom has a high degree of confidence that the auction, including the payment of the auction fees, will secure efficient use of the spectrum during the minimum term. However, it is less clear that this objective will be met after the minimum term. The longer the period over which a regulator is required to look forward, the greater the uncertainty that exists. Also, what is optimal at the time of the award might not continue to be optimal as things change. At present, the ability to revoke licences on spectrum management grounds, and the ability to charge fees (including to promote optimal use of the spectrum) are important mechanisms in the regulator's toolkit. It is considered proportionate and objectively justifiable to include provisions allowing either regulator to make use of them if appropriate after the end of the minimum term of these licences. The inclusion of these provisions is transparent as to what it seeks to achieve and does not unduly discriminate against any person.
- 7.17 Ofcom would expect to give prior notice at the time of any specific proposal to use the power of revocation, or the charging of fees, and to consult as appropriate.

## Band management arrangements in Northern Ireland

- 7.18 In section 6 above, a role for Band Managers in the UK is identified. The potential for organisations to act as Band Managers (spectrum management organisations) in the UK has been considered by Ofcom. This section discusses the provisions proposed for band managers in Northern Ireland.
- 7.19 The potential for organisations to act as Band Managers is discussed in Ofcom's consultation document on the award of available spectrum: 412-414 MHz paired with 422-424 MHz (section 4)<sup>10</sup>. That document looks, in particular, at how a Band

<sup>10</sup> [Ofcom Website | Award of available spectrum: 412-414 MHz paired with 422-424 MHz](#)

Manager might be able to operate within the UK's spectrum trading regime. Ofcom does not intend to make specific provision for the creation of a Band Manager - either in the 412-414 MHz/412-424 MHz band, 1785-1805 MHz band, or other bands. Instead it intends to ensure that the framework allows a Band Manager to emerge where there is a suitable commercial opportunity. Any entity wishing to acquire spectrum for the purposes of trade would compete for the licence with others, who might wish to obtain the rights to a band for their own operations. If the entity was successful in winning a licence it would establish its operation on the basis of the spectrum rights contained in its licence, which includes the right to trade the spectrum, and on commercial contracts with the customers, to whom it would transfer spectrum usage rights and obligations.

### **Spectrum trading in Northern Ireland**

- 7.20 Spectrum trading allows holders of wireless telegraphy (WT Act) licences to transfer some or all of their rights and associated obligations under those licences, to others, under various types of transfer. From the outset the licence to be awarded in Northern Ireland will be tradable.
- 7.21 Different types of transfer are allowed by the regulations made by Ofcom, under the Communications Act 2003, which permit spectrum trading. The current regulations are the Wireless Telegraphy (Spectrum Trading) Regulations 2004 and allow for:
- transfers for all or only certain parts of the rights and associated obligations under a licence - i.e. 'total' or 'partial' transfers; and
  - transfers such that the acquirer of the rights and associated obligations holds them to the exclusion of the original holder, or concurrently with them - i.e. 'outright' or 'concurrent' transfers.
- 7.22 Further information on trading can be found at: Ofcom's policy statement on spectrum trading can be found at [http://www.ofcom.org.uk/consult/condocs/spec\\_trad/statement/sts.pdf](http://www.ofcom.org.uk/consult/condocs/spec_trad/statement/sts.pdf). The Trading Regulations are published by OPSI and available at [www.opsi.gov.uk](http://www.opsi.gov.uk).
- 7.23 Ofcom expects to amend the existing regulations prior to award of this Spectrum Band, to extend trading to this licence.

### **Liberalised use of the Spectrum Band in Northern Ireland**

- 7.24 In January 2005, Ofcom published a statement on spectrum liberalisation, (the "Liberalisation Statement") describing changes in the way licensees of particular licence classes can use the spectrum. These changes are being implemented in stages to facilitate the optimal use of the spectrum. The full statement and associated documents can be found at: <http://www.ofcom.org.uk/consult/condocs/liberalisation/> and <http://www.ofcom.org.uk/radiocomms/ifi/trading/libguide/>.
- 7.25 The spectrum liberalisation process described in the statement includes changes to three licensing sectors in 2005 – Business Radio, Fixed Wireless Access and Fixed Links – and the use of two mechanisms for liberalisation of spectrum use – through individual licence variation, following a request by a licensee, or through a generic licence change applied by Ofcom. The licence for Northern Ireland proposed for award in the Spectrum Band will bear conditions similar in principle, in terms of technology neutrality and possible change of use, to those that Ofcom aims to introduce in time, through a generic change to existing licences in a given class or sector.

- 7.26 In the SFR:IP, Ofcom indicated its plan to award the Spectrum Band in a technology and application neutral way. The Licensee will be free to deploy the technologies of its choice and change its use of the spectrum or these technologies within the spectrum mask, without requiring Ofcom's approval. A discussion of responses received to the SFR:IP consultation on technology neutrality and other issues is contained in Annex D.
- 7.27 In Northern Ireland, any change by a licensee in the Spectrum Band that would depart from its respective licence conditions (e.g. power level and out-of-block emission mask) will be subject to prior approval by Ofcom. The same will apply to any change by the licensees in adjacent bands that would depart from the conditions in those licences. Ofcom will consider any requests for change on their merits at the time.

## Section 8

# Auction design and rules

## Auction format options

- 8.1 Analysing the options for auction format is complicated by the potential synergies that may be available to an operator wishing to operate in both Northern Ireland and Ireland. These synergies are identified in sections 4 and 6. This means that bidders wanting to exploit these synergies could face possible aggregation risks - i.e. there is a risk that a firm which only wins one licence could end up stranded having overpaid for it because their bid included part of the premium they expected from holding both licences. One appropriate way to deal with this issue would be to have a combinatorial auction which would allow firms to enter separate bids for any or all of the following: both licences together, or each licence separately. However this option is not legally feasible, given that the two awards are being made in separate jurisdictions.
- 8.2 ComReg and Ofcom have therefore tried to find the next best solution and have considered four options:
- two sequential sealed bid auctions;
  - two sequential simultaneous multi-round ascending (SMRA) auctions;
  - two simultaneous SMRA auctions; and
  - two simultaneous sealed bid auctions.
- 8.3 The key criteria used to assess these options include:
- promoting the efficiency of the outcome of the auctions;
  - facilitating the realisation of synergies in the auction if that is the most efficient outcome;
  - encouraging participation in the auction if there are bidder asymmetries;
  - dealing with common value uncertainty; and
  - simplicity and practicality.
- 8.4 The fourth option, two simultaneous sealed bid auctions, has been discarded because it does not allow the realisation of synergies - bidders would have no way of judging their likelihood of winning both auctions and would essentially be unable to mitigate aggregation risks. The sequential sealed bid option is discussed in more detail in the paragraphs below. The remaining two options, two simultaneous SMRA auctions and two simultaneous sealed bid auctions are discussed in more detail in Annex E.

## Sequential sealed bids

- 8.5 Holding sequential auctions facilitates the realisation of synergies to some degree. Bidders can set their strategy for the second auction contingent on the outcome of the first auction. This eliminates the possibility of overpaying for whichever licence is auctioned second.

- 8.6 A second advantage of this format is that sealed bid auctions should encourage 'weak' bidders to participate in the auction more than an SMRA format. Ofcom's research indicates that bidder asymmetry could be an issue in this auction, although the evidence is far from conclusive. Finally, a sequential sealed bid process also benefits from being practical and low cost to implement, and carries minimal risk of auction failure because the bidding process is not complex.
- 8.7 The main disadvantage of a sequential process is that the winner of the first auction still runs the risk of not winning the second licence and ending up having overpaid for the first licence. This could affect bidding strategies and lead to inefficient outcomes, in particular synergies may not be fully realised even when they turn to be the most efficient outcome. If there is a significant difference in the size of the two potential markets, holding the first auction in the jurisdiction which has the larger potential market may limit the potential impact of aggregation risks. This is because the synergies will have less of an impact on the viability of services in the jurisdiction with the larger potential market.

## Conclusion

- 8.8 On the basis of the available evidence, Ofcom and ComReg consider that a sequential sealed bid process with a second price rule is likely to secure the greatest benefit in terms of the efficient allocation of the spectrum and realisation of potential synergies in the context of efficient use of the spectrum. It also appears to be simpler and more practical to implement than the other options considered. The principal alternative in theory would be a simultaneous SMRA process. However, Ofcom's research has shown that it appears difficult to find a practical way of designing a simultaneous SMRA process which is capable of facilitating the realisation of synergies and which avoids strategic complexity for bidders. A fuller discussion of the reasoning is contained in Annex E.

## Auction rules

- 8.9 This section sets out the proposed auction rules and current thinking for how the key auction rules will be specified. It also outlines ComReg's and Ofcom's current expectations for how the auction process is likely to be conducted.
- 8.10 The auction rules cover issues such as:
- determination of who the winning bidders are – for example how winners will be chosen if there is a tie;
  - how much the winning bidders have to pay - sometimes an auction is better at eliciting how much people are willing to pay if they know that they will not have to pay what they bid, but some other value such as what the highest loser bids;
  - the size of the deposit required – deposits are a useful way of encouraging bidders not to bid amounts that they cannot afford in the auction and subsequently default on their bids; and
  - the reserve price – this needs to be set at a level that reflects the objectives of the auction.
- 8.11 The sections below discuss the options for setting the auction format and then, in the light of ComReg's and Ofcom's preferred format, the choice of auction rules.

## Pricing Rule

- 8.12 The choice of pricing rule is also an important factor in the effectiveness of this option. If there is a first price rule, i.e. the winning firm pays what they bid, firms wanting licences in both jurisdictions will be cautious about how much of the potential “synergy premium” they bid in the first auction, in case they do not win the second<sup>11</sup>. However, if there are firms which only want to compete in the first auction, they will bid aggressively because they will be aware that the other bidders are likely to shade their bids. A first price rule therefore carries a risk that a bidder wanting to exploit the synergies in operating in Ireland and Northern Ireland may not win the licences even though it valued the licences most highly.
- 8.13 A second price rule, where the winning firm pays the value of the next highest bid, is better at allowing synergies to be realised than a first price rule. Firms which want to acquire both licences have an incentive to bid more aggressively with regard to the “synergy premium”, since if they win they will only pay the second highest bid. Aggregation risks are not fully eliminated, but should be lower than under a first price rule.

## Effects on revenue

- 8.14 It is not the objective of either ComReg or Ofcom to maximise the revenues received by way of the auctions in Ireland or Northern Ireland. The objective of the assignment process is to secure optimal use of the spectrum, not to derive any particular revenues.
- 8.15 It is important to note this point in the context of the discussion about adopting a second price rule for determining the outcome of the auction. ComReg and Ofcom are aware that the use of a second price rule may lead to an outcome where the price paid for one or other of the licences could be significantly less than the willingness to pay as revealed in the auctions. However, the second price rule is appropriate because of its superior effects on the efficiency of the auctions. In a similar way, the sequencing of the auctions may also have an effect on the balance of revenues as between the two auctions, but ComReg and Ofcom consider that the sequencing proposed is the best in terms of the auction objectives, of the options available.

## Strategic manipulation and collusion

- 8.16 The economic literature on auctions suggests that in auction design, as in other areas of regulatory policy, it is especially important to address issues such as reducing the potential for predatory and collusive behaviour.
- 8.17 Some auction designs may be vulnerable to strategic behaviour by bidders attempting to influence the auction outcome in their favour. For example, it may sometimes be possible for ‘strong’ bidders to collude, tacitly or otherwise, to fix the number of licences or influence the price that they pay.
- 8.18 Notwithstanding the use of a sealed bid auction format and the general prohibition on collusion under European competition law, it is still possible that bidders could collude to try to gain an advantage over other bidders by co-ordinating their bids or otherwise act to distort the auction outcome. This suggests that there should be

<sup>11</sup> In addition, firms will try to bid the minimum necessary to win each licence under this pricing rule, giving them another incentive to shade their bids.

specific auction rules prohibiting collusion and other behaviour which could distort the auction outcome.

## Aggregation

8.19 Designing a simultaneous SMRA process that adequately addresses aggregation risks may significantly add to the complexity of the auction design. The design would need at least the following special features:

- allowing bidders to withdraw to avoid being stranded with a licence whose value falls below what they bid because they are unable to capture the synergy value in Northern Ireland and Ireland; and
- allowing bidders to remain in the auction without bidding in every round.

8.20 In an SMRA auction, withdrawal rules may create bidding strategies that lead to perverse outcomes, such as long periods of inactivity in the auction because bidders do not want to give away information about their true valuations. Our research has shown that inefficient outcomes could easily occur depending upon the differences in bidders relative valuations of the Northern Ireland and Irish licences and the reserve prices for these. Bidders could face significant strategic complexity in a simultaneous process, and the risk of auction failure is therefore high.

## Summary

8.21 ComReg and Ofcom believe that a sequential auction, while carrying some aggregation risk, will not lead to such strategic complexity for bidders and that the risk of auction failure is therefore lower. However, potential demand for the licences indicates that a simpler auction format may be more appropriate. Moreover, in Northern Ireland the licence will be tradable and this may limit the potential aggregation risk.

## Sequencing

8.22 Ofcom and ComReg have assessed the potential effects of the two different ways of sequencing the awards, and propose that the sequence should be Ireland first followed by Northern Ireland. Our research has indicated that this sequence appears more likely to realise synergies than the alternative order. The key issue is whether the order of the auctions will make a difference on bidding behaviours and, as a result, the efficiency of the outcome of the auctions. Ofcom and ComReg believe that the risk that the outcome of the auctions is inefficient is higher if the Northern Ireland auction is held first.

8.23 This is because the potential synergies are likely to represent a significantly larger proportion of the value of the Northern Ireland licence than the Ireland licence, as a licence in Ireland is more likely to be viable as a 'standalone' licence. As a result, bidders that want to buy both licences, are more likely to bid cautiously in the auction for the licence if the Northern Ireland auction is first, because they will perceive the risk or the downside effect of being stranded as greater. In contrast, because the synergy is a lower proportion of the Ireland licence, bidders are likely to bid more aggressively because the risk of being stranded is perceived as lower.

## Summary

8.24 The use of a second price rule may lead to an outcome where the price paid for one or other of the licences could be significantly less than the willingness to pay as



revealed in the auctions. However, a second price rule is appropriate because of its superior effects on the efficiency of the auctions.

- 8.25 In a similar way, the sequencing of the auctions may also have an effect on the balance of revenues as between the two auctions, but ComReg and Ofcom consider that the sequencing proposed is the best in terms of the auction objectives, of the options available. Synergies are more likely to be realised by ordering the award in Ireland first and Northern Ireland second.

### **Transparency of the bidding process**

- 8.26 It is proposed that the auction format should be transparent, meaning that:

- the identity of all registered bidders will be published before the auction; and
- full information about the results of the auction and all bids submitted will be published following completion of the single round.

- 8.27 Making the auction transparent offers a number of advantages. In the case of a sealed bid, bid levels are determined not only by bidders' own valuations but also by their perception of competition. Providing bidders with information about the identity of competitors will make it easier for them to judge the appropriate bid level, thus reducing the risk of an inefficient outcome (i.e. one where the bidders with the highest value fail to win a licence).

### **Reserve prices**

- 8.28 Because the auctions are separate and because the licences are expected to have different values that reflect the size of the market that can be addressed in Ireland and Northern Ireland, it is proposed that two reserve prices will be set, one for the licence awarded by ComReg and one for the licence to be awarded by Ofcom.

- 8.29 The reserve price proposed by Ofcom is £50,000. The reserve price proposed by ComReg is €150,000.

- 8.30 These reserve prices are established on the basis of the shared primary objective in the auction: to promote the optimal use of the spectrum. The main function of the reserve prices will be to deter frivolous bidders and both prices proposed are set at the minimum level necessary to do this without deterring genuine bidders.

### **Deposits**

- 8.31 Deposits are upfront payments that will be forfeit if a bidder breaks specific auction rules or a winning bidder defaults on its payment. They help to deter frivolous bidders, similarly to reserve prices, and to reduce strategic incentives for default.

- 8.32 Deposits will be required in the form of cash deposits and bidders will be required to submit these at the same time as the bid form. If a bidder does not provide a deposit for its bids (by the relevant deadline), its bids will be declared invalid.

### **Summary**

- 8.33 ComReg and Ofcom propose to set the level of the deposit at 50% of the amount bid for each licence. Given that ComReg and Ofcom are uncertain about the value that bidders place on licences, setting deposits based on the proportion of the amount bid



appears the only way to ensure that the deposit is sufficient to deter strategic default but not excessively onerous on bidders in the auction.

### **Payment terms and default**

- 8.34 ComReg and Ofcom propose that winning bidders will pay 100% of the fee for their licence by a specified time and licences will only be issued after payment has been received. This will encourage bidders to consider their bids and the business plans behind them carefully and will discourage default on the licence. If a bidder defaults on payment for the licence it will forfeit its deposit and remain liable for the outstanding balance and of course it will not be granted a licence.
- 8.35 Also if default occurs then the licence will be offered to unsuccessful bidders for that option in rank order of their bids, at the price bid by the bidder who defaulted.

### **Auction procedure**

- 8.36 This section provides a summary of the bidding process and key auction rules for each auction and gives some examples of how the winners will be determined. It also provides an example of how ComReg and Ofcom expects the auction processes to work.

### **Summary of the bidding process and rules**

- 8.37 The proposed format is a sealed bid auction. In each jurisdiction the bidding process and rules are as follows:
- Bidders submit a single application form to ComReg and Ofcom, indicating whether they wish to bid for the licence offered by ComReg or the licence offered by Ofcom or both.
  - The identity of all registered bidders will be published before the auctions.
  - Collusion between registered bidders will be prohibited.
  - There is only one round of bidding in each auction.
  - Bids will be in euros for the licence offered by ComReg and in whole pounds sterling for the licence offered by Ofcom and a minimum bid reserve price will be set for each of the two licences.
  - The winning bid will be the highest bid submitted for each licence. Bids will be treated separately.
  - Winning bidders pay the amount of the second highest bid or the reserve price, whichever is the greater.
  - In each auction separately, a tie between bidders is settled by the drawing of lots.
  - Full information about the identity of the winning bidders, the amounts paid, and the amount and identity of all other bids submitted will be published following completion of each auction.

### **Procedures for unsold licences**

- 8.38 There are two main ways in which a licence may remain unsold:
- through default; and

## **Award of available spectrum: 1785 - 1805 MHz**

- it is possible that after the auction, even in the absence of default, licences will remain unsold because there are no bids for a licence or the bids have not reached the reserve price.
- 8.39 It is possible that after the auction one or both licences remain unsold. If this occurs, ComReg and Ofcom have a number of options available to them including cancelling the award, awarding the licence(s) on a first come-first served basis, and holding a further auction. If this circumstance arises ComReg and Ofcom will each determine how to proceed in the light of circumstances at that time.

### **Examples of invalid bids or bids that would not be taken into account**

- 8.40 For illustrative purposes, the following are examples of bids which would be in breach of the proposed rules. Such bids would not be taken into account in determining the winning option and the winning bid.
- Any bids received by the auctioneer outside the relevant period.
  - Any bid below the relevant reserve price.
  - Any bid for which no cash deposit has been received by the auctioneer(s) before the relevant deadline.
  - Any bid submitted by a bidder found to be in breach of the rules on collusion.
  - Any bid submitted by an entity who is not a registered bidder.

### **Examples of interested parties who would not qualify as registered bidders**

- 8.41 For illustrative purposes, the following are examples of interested parties who would not qualify as registered bidders under the proposed rules. Any bid they may submit would not be taken into account in determining the winning option and the winning bid.
- Any party who has not submitted a valid application to become a provisional bidder in the relevant auction before the relevant deadline.
  - Any party who has not submitted a valid application to become a registered bidder before the relevant deadline.
  - Any party who is found to be in breach of the rules on collusion, from the moment the breach is identified.

## Annex A

# Consultation questions

A.1 In this Annex we re-state the questions that are posed in the body of the consultations document. The questions asked are as follows:

A.2 Question 1. This asks stakeholders whether they agree with the proposals for the award of this band or have any other comments on the contents of this document.

*Q.1 Do stakeholders agree with these proposals for the award of this band or have any other comments on the contents of this document?*

A.3 Question 2. This question seeks views on proposals relating to the licence exempt use of the Spectrum Band.

*Q.2 What are your views on the proposal to discontinue the use of the 1785-1800 MHz band by radio microphones and 1795-1800 MHz by wireless audio devices on a licence exempt basis?*

A.4 Question 3. This deals with the proposal to limit the number of licences to one for each jurisdiction.

*Q3 What are your views on the proposal to limit the number of licences to one for Ireland and one for Northern Ireland?*

A.5 Question 4. This question seeks views on the proposed radiated power limit within the Spectrum Band.

*Q.4 What are your views on the proposed limit of 56 dBm/MHz EIRP maximum radiated power that may be used in the Spectrum Band?*

A.6 Question 5 seeks your views on technical aspects of the award including the methods, limits and approach to a coordination threshold.

*Q.5 Do you think that the methods, limits and approach to a threshold for coordination proposed above are appropriate? If not, what measures do you think would be appropriate?*

A.7 How to respond to ComReg and Ofcom is set out in Annex B.

## Annex B

# Responding to this Consultation

B.1 It is ComReg's and Ofcom's intention to publish a joint statement on this consultation document. You are therefore invited to send your views and comments on this consultation to either ComReg or Ofcom. ComReg and Ofcom expect to share all responses including confidential responses.

### How to respond

B.2 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 questions are listed together at Annex A. It would also help if you can explain why you hold your views, and how the proposals would impact on you.

B.3 You are invited to send your written views and comments on the issues raised in this document, to be made by **5pm on 2 March 2006**.

B.4 ComReg and Ofcom strongly prefer to receive responses as e-mail attachments, in Microsoft Word format, as this helps us to process the responses quickly and efficiently.

B.5 Note that we do not need a hard copy in addition to an electronic version. Also note that we will not routinely acknowledge receipt of responses.

B.6 **If you wish to respond to ComReg**, send your response clearly marked: -"Reference: Submission re ComReg 05/93", and send preferably by email (or on-line at [www.comreg.ie](http://www.comreg.ie))

To

**Sinéad Devey**  
Commission for Communications Regulation  
Irish Life Centre  
Abbey Street  
Freepost  
Dublin 1  
Ireland

Ph: +353-1-804 9600 Fax: +353-1-804 9680 Email:  
[marketframeworkconsult@comreg.ie](mailto:marketframeworkconsult@comreg.ie)

B.7 When responding to ComReg, please note:

B.8 In order to promote further openness and transparency, it is ComReg's intention to publish all respondents submissions upon receipt, subject to the provisions of ComReg's guidelines on the treatment of confidential information – see ComReg 05/24. Please indicate on the cover sheet at the end of this annex if this is acceptable. Please note that this is a departure from ComReg's normal practice and is being done in this instance in order to facilitate both ComReg's and Ofcom's processes under this joint initiative.

- B.9 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.
- B.10 As it is ComReg's policy to make all responses available on its web-site and for inspection generally, respondents to consultations are requested to clearly identify confidential material and place confidential material in a separate annex to their response.
- B.11 Such Information will be treated subject to the provisions of ComReg's guidelines on the treatment of confidential information – ComReg 05/24.
- B.12 **If you wish to respond to Ofcom**, please send your response to:  
[stephen.jones@ofcom.org.uk](mailto:stephen.jones@ofcom.org.uk).
- B.13 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

Stephen Jones  
Floor 3  
Spectrum Policy Group  
Riverside House  
2A Southwark Bridge Road  
London SE1 9HA  
Fax:020 7783 3333

- B.14 When responding to Ofcom please complete a response cover sheet (see Annex 2).
- B.15 The response cover sheet is available from the 'Consultations' section of Ofcom's website at: <http://www.ofcom.org.uk/consult/244504/>

### **Further information**

- B.16 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact

For ComReg:

Susan Fleming on +353-1-804 9600

For Ofcom:

Stephen Jones on +44 (0) 20 7783 4381

### **Ofcom statement on confidentiality**

- B.17 It is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website [www.ofcom.org.uk](http://www.ofcom.org.uk), ideally on receipt (when respondents confirm on their response cover sheet that this is acceptable).
- B.18 All comments will be treated as non-confidential unless respondents specify that part or all of the response is confidential and should not be disclosed. Please place any confidential parts of a response in a separate annex, so that non-confidential parts may be published along with the respondent's identity.

## Award of available spectrum: 1785 - 1805 MHz

- B.19 Ofcom reserves the power to disclose any information it receives where this is required to carry out its legal requirements. ComReg and Ofcom will exercise due regard to the confidentiality of information supplied.
- B.20 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to ComReg and Ofcom to use, to meet their legal requirements. Ofcom's approach on intellectual property rights is explained further on its website, at [www.ofcom.org.uk/about\\_ofcom/gov\\_accountability/disclaimer](http://www.ofcom.org.uk/about_ofcom/gov_accountability/disclaimer).

### Next steps

- B.21 Following the end of the consultation period, a statement will be published.
- B.22 Please note that you can register to get automatic notifications of when Ofcom documents are published, at [http://www.ofcom.org.uk/static/subscribe/select\\_list.htm](http://www.ofcom.org.uk/static/subscribe/select_list.htm).

### Ofcom's consultation processes

- B.23 Ofcom is keen to make responding to consultations easy, and has published some consultation principles which it seeks to follow, including on the length of consultations.
- B.24 Ofcom has published seven principles that it will follow for each written consultation. We believe that this consultation complies with these principles.
- B.25 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at [consult@ofcom.org.uk](mailto:consult@ofcom.org.uk). We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, whose views are less likely to be obtained in a formal consultation.
- B.26 If you would like to discuss these issues, or Ofcom's consultation processes more generally, you can alternatively contact Vicki Nash, Director, Ofcom Scotland, who is Ofcom's consultation champion:

Vicki Nash  
Ofcom Scotland  
Sutherland House  
149 St Vincent St  
Glasgow G2 5NW  
Tel: 0141 229 7401  
Fax: 0141 229 7433  
E-mail: [Vicki.Nash@ofcom.org.uk](mailto:Vicki.Nash@ofcom.org.uk)

### Consultation response cover sheet

- B.27 In the interests of transparency, we will publish all consultation responses in full at [www.comreg.ie](http://www.comreg.ie) and [www.ofcom.org.uk](http://www.ofcom.org.uk), unless a respondent specifies that all or part of their response is confidential. We will also refer to the contents of a response when explaining our decision, without disclosing the specific information that you wish to remain confidential.
- B.28 A cover sheet for responses is provided below. Please send one with your response. This will speed up our processing of responses, and help to maintain confidentiality by

allowing you to state very clearly what you don't want to be published. We will keep your completed cover sheets confidential.

- B.29 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore ComReg and Ofcom encourage respondents to complete their cover sheet in a way that allows ComReg and Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.
- B.30 We strongly prefer to receive responses in the form of a Microsoft Word attachment to an email. Our website therefore includes an electronic copy of this cover sheet, which you can download from the 'Consultations' section of our website.
- B.31 Please put any confidential parts of your response in a separate annex to your response, so that they are clearly identified. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only so that we don't have to edit your response.

## Cover sheet for response to this consultation

### BASIC DETAILS

Consultation title: Award of available spectrum: 1785 - 1805 MHz

For responses to ComReg contact: [marketframeworkconsult@comreg.ie](mailto:marketframeworkconsult@comreg.ie)

or

For responses to Ofcom contact: [stephen.jones@ofcom.org.uk](mailto:stephen.jones@ofcom.org.uk)

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

### CONFIDENTIALITY

What do you want Ofcom or ComReg to keep confidential?

Nothing

Name/contact details/job title

Whole response

Organisation

Part of the response

If there is no separate annex, which parts?

ComReg and Ofcom expect to share all responses including confidential responses. If you want part of your response, your name or your organisation to be confidential, can ComReg or Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

### DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response. It can be published in full on ComReg's and Ofcom's websites, unless otherwise specified on this cover sheet, and I authorise ComReg and Ofcom to make use of the information in this response to meet its legal requirements. If I have sent my response by email, ComReg and Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name

Signed (if hard copy)



## Annex C

# Further technical information

### Interference mechanisms

- C.1 Theoretical interference calculations may be based on the ETSI specifications for GSM 1800, ETS 300 577 (GSM 05.05). These specifications are primarily intended to assure good (GSM 1800) intra-system performance and it may not be appropriate to assume that all the parameters can be directly applied to inter-system compatibility calculations (e.g. blocking levels, receiver inter-modulation (IM) signal generation), since different interfering signals are used.
- C.2 The potential interference mechanisms that should be considered are:
- spurious emissions;
  - receiver blocking;
  - receiver interference performance;
  - out of band emissions (including transients in some cases; and
  - inter-modulation products.
- C.3 Theoretical interference calculations may be based on the ETSI specifications ETS 300 577 (GSM 05.05). These specifications are primarily intended to assure good intra-system performance and it may not be appropriate to assume that all the parameters can be directly applied to inter-system compatibility calculations (e.g. blocking levels, receiver inter-modulation (IM) signal generation), since different interfering signals are used.
- C.4 Short range devices (e.g. radio microphones) have not been considered in this analysis as they operate on a non-interference and non-protected basis in Ireland. The analysis also does not consider a spectrum block specification to protect against interference between more than one 'new' system licensed in 1785–1805MHz.

### Spurious emissions

- C.5 The required isolation values due to spurious emissions are generally higher, than those for out-of-band emissions. But these levels should not be treated as a (continuous) noise floor. The spurious signals will be likely to appear at a few specific frequencies. It may be possible to mitigate against spurious emissions by techniques such as Dynamic Channel Selection that could be deployed at 1785–1805 MHz and by intra-cell hand over in GSM 1800 networks.

### DCS 1800 receiver blocking

- C.6 The ability of the DCS1800 receiver to receive a desired signal in the presence of a strong interfering signal on any frequency is described by its blocking specification.
- C.7 Assuming an “in band” interferer at 600–800 kHz frequency separation from a DCS1800 carrier the maximum protection required for DCS 1800 receiver blocking using Minimum Coupling Loss (MCL) is as follows:

$$\text{Isolation} = P_{\text{INT}} + G_{\text{INT}} + G_{\text{VICT}} - \text{dB}_{\text{VICT}}$$

**Award of available spectrum: 1785 - 1805 MHz**

Where:

$P_{INT}$  is the maximum transmit power of the interferer;

$G_{INT}$  is the gain of the interferer antenna (incl. cable loss);

$G_{VICT}$  is the gain of the victim antenna (incl. cable loss) = 17dBi; and

$dB_{VICT}$  is the blocking performance of the victim receiver, the frequency offset being considered = -35dBm.

C.8 Therefore, the maximum Isolation/Protection required for DCS 1800 receiver blocking:

$$\text{Isolation/Protection Req'd} = P_{INT} + G_{INT} + 52\text{dBm}$$

C.9 This value will represent a required protection which can be achieved by filtering in the 'new' transmitter (e.g. meeting a block edge mask) or a physical separation where practicable or a combination of these.

**DCS 1800 Receiver Interference due to unwanted emissions from adjacent Interferer**

C.10 The receiver interference specification mainly relates to interference occurring within the DCS 1800 band. When out-of-band emissions from an interfering system on an adjacent band fall into the own band, it is the interference on the radio channel (co-channel interference) that normally dominates. Thus the co-channel carrier-to-interference performance, C/I, is an important parameter.

C.11 The isolation or protection required by DCS 1800 from adjacent systems interfering on a co-channel basis as a result of unwanted emissions is as follows:

$$\text{Isolation} = P_{INT} + dB_{BW} + G_{VICT} + G_{INT} - (S_{VICT} - C/I_{VICT}) + dB_{INT}$$

Where:

$P_{INT}$  is the maximum transmit power of the interferer;

$dB_{BW}$  is the bandwidth conversion factor between interferer and victim;

$G_{VICT}$  is the gain of the victim antenna (incl. cable loss) = 17 dBi;

$G_{INT}$  is the gain of the interferer antenna (incl. cable loss);

$S_{VICT}$  is the sensitivity of the victim = -102 dBm;

$C/I_{VICT}$  is the protection ratio of the victim = 9 dB;and

$dB_{INT}$  is the power of the wideband noise at the frequency offset being considered relative to the interferer's carrier power.

C.12 Therefore, the maximum ratio of Isolation to protection required for DCS1800 due to out-of-band emissions from an adjacent interferer:

$$\text{Isolation/Protection Req'd} = P_{INT} + dB_{BW} + G_{INT} + dB_{INT} + 128\text{dB}$$

C.13 This value will also represent a required protection which can be achieved by filtering in the 'new' transmitter (e.g. meeting a block edge mask) or a physical or frequency separation where practicable or a combination of these.

### **Protection level for other radio services equal to the DCS 1800 noise floor minus 6dB**

DCS 1800 Receiver Noise Floor:

$$N = kTB$$

$$N = (1.38 \times 10^{-23})(300)(100 \times 10^3)$$

$$= 4.14 \times 10^{-16}$$

$$= -153.8 \text{ dBW}$$

$$N_f = -149.8 \text{ dBW or } -119.8 \text{ dBm per } 100 \text{ kHz}$$

Where: f is the receiver noise factor [this is 4dB]

Protection level equal to the DCS1800 noise floor minus 6dB =  $-119.8 - 6 = -126$  dBm/100 kHz

C.14 This interference limit into the DCS 1800 channel is completely independent of technology used for the other service.

### **Spurious emission level as defined in Appendix 3 of the Radio Regulations**

C.15 Appendix 3 of the ITU Radio Regulations defines the maximum unwanted emissions level in the spurious domain. The spurious domain is generally considered to start at approximately  $2.5 \times B_N$  frequency separation from the carriers centre frequency (where  $B_N$  = transmitters necessary bandwidth). In this case the spurious emissions level will be considered a candidate level for the block edge mask level.

C.16 The spurious emissions limit is defined relative to the transmitter total mean power (P) and are valid in a 1MHz reference bandwidth.

$$\text{Relative spurious emissions level } (S_L) = 43 + 10 \log(P)$$

Where: P is the 'new' transmitter power in Watts.

Therefore,

$$\text{Block Edge Mask Level (dBm)} = P_{\text{INT}} - S_L - 30\text{dB}$$

Where:

$P_{\text{INT}}$  is transmitter power (dBW) of the 'new' service; and

$S_L$  is the relative spurious emissions level.

## Effective bandwidth within the Spectrum Band

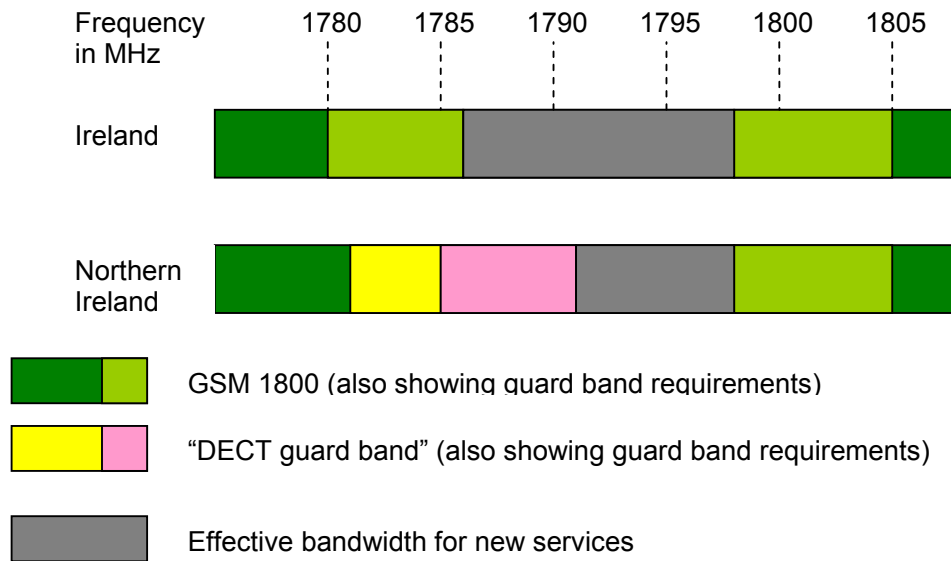
C.17 The amount of effective bandwidth within the Spectrum Band depends upon the technology deployed within the band and the protection requirements for services using adjacent spectrum. ComReg and Ofcom have carried out some technical studies to determine what measures might be required to mitigate the effects of interference to adjacent band (e.g. DECT/GSM1800) services. The effective bandwidth will therefore vary depending upon the technology deployed in the Spectrum Band and on the characteristics of the adjacent band services. As examples, where the technology deployed in the Spectrum Band can be characterised by parameters for UMTS Time Division Duplex (TDD):

- a guard band of 6.25 MHz could be required to protect GSM1800 base station receivers from TDD base station emissions and to protect GSM1800 mobile station receivers from TDD base station emissions, and
- where guard bands are required to protect digital wireless microphones, 1.25 MHz might be required at each end of the Spectrum Band.

C.18 These requirements must be met from within the Spectrum Band. This has the effect of reducing the usable spectrum within the Spectrum Band for new services. Given the differing approaches to the “DECT guard bands” uses, analysis suggests that 12.5 MHz of the 1785-1805 MHz band would be usable in Ireland and 7.5 MHz would be usable in Northern Ireland. See Figure C.1. The example analysis of usable spectrum within the Spectrum Band given here only applies to TDD based technology deployed in a cellular configuration; different guard bands may be necessary for other technologies and services.

C.19 Under the conditions of technical and application neutrality proposed, licensees will be able to determine appropriate guard bands within the Spectrum Band, but must ensure that services in adjacent spectrum are protected from harmful interference. The guard bands may vary in slope and amplitude, but at the block edge they must reduce emissions from in-band signals sufficiently to meet the level of protection specified in section 5. The level of protection for adjacent band spectrum users is shown graphically by Figure C.2.

**Figure C.1 Example of effective bandwidth**



C.20 In Northern Ireland, the DECT guard band identified above in Figure C.1 could also be used for low power services.

**Receiver interference and blocking**

C.21 Receiver interference relates to receiver co-channel carrier-to-interference performance, C/I ratio, and to the ability of victim receivers to attenuate interference on the adjacent channels. Theoretically it is possible that a guard band of 6 MHz would be necessary before suitable duplex filtering would protect the GSM system to the same standard as the maximum out-of-band blocking power.

C.22 Receiver interference specification mainly relates to interference occurring within the adjacent. When out-of-band emissions from an interfering system fall into the adjacent band it is the co-channel interference that is likely to be the dominant effect. Blocking performance in this frequency range is critical. The blocking performance for a GSM base station includes the following:

**Table C.1 Blocking performance of GSM base stations**

Frequency Offset (kHz)	Maximum blocking power (dBm)	Correct for antenna gain 17 (dB)	Correct to protect to 1 dB desensitisation (-6 dB)
600 – 800	-35	-52	-58
800 – 1600	-25	-42	-48
1600 - 3000	-25	-42	-48
>3000	-25	-42	-48
Out of Band	0	-17	-23

### Blocking from GSM 1800 BTS transmissions

C.23 Blocking does not necessarily mean that the receivers of the new service will go into saturation as receivers would be expected to have already been designed to withstand interfering levels of –5 dBm to 0 dBm with a constant ratio between wanted signal and interfering signal for a constant performance.

### Inter-modulation interference

C.24 If it is assumed that the probability of inter-modulation interference is low, mitigation against it may be possible by intra-cell hand over in systems in adjacent bands and Dynamic Channel Selection in the new service.

### Engineering coordination for interference management

C.25 The award processes proposed allow for the possibility that separate networks could be deployed in Ireland and Northern Ireland using different technologies or that different uses may arise from trading in Northern Ireland. As an example of the effect that this can have on network planning for interference management, if practical antenna heights (e.g. between 3m and 10m above ground level) are adopted, the separation distance between un-co-ordinated base stations using UMTS TDD-like technologies could be between 50 and 70 kilometres.

### Field strength threshold for coordination

C.26 With a proposed 26 dBW/MHz EIRP emission limit and typical antenna heights of 3m to 10 m (above ground) for outdoor antenna installations, it is extremely likely that the field strength threshold specified in the cross border coordination arrangement will be needed when separate networks are deployed within 50km to 70km of the border and the licences are held by different companies in Ireland and Northern Ireland. Under this circumstance ComReg and Ofcom will require licensees to respect the field strength requirements contained in these and any future agreements negotiated between the administrations for the Spectrum Band.

C.27 For information and as examples, the simulations presented in the following paragraphs have been carried out using a proprietary modelling tool and the parameters given below.

## Simulation parameters

Operating frequency: 1790 MHz  
Power: (a) 32 dBW/MHz and (b) 25 dBW/MHz  
Transmitter antenna height: 20m  
Receiver antenna height: 10m  
Receiver Sensitivity Level (RSL) for GSM 1800: -102 dBm/200 kHz

C.28 Propagation model: (a) ITU-R. Rec. P. 1546, 10% time, 50% locations and (b) ITU-R. Rec. P.370-7, 10% time, 50% locations.

C.29 Figures C.2 and C.3 below show simulations of the areas where the field strength on the coast of Great Britain received exceeds the receiver sensitivity level for GSM 1800. In these simulations stations were located on the coast of Ireland with omni-directional antennas in order to assess the level of field strength that could be received on the coast of Great Britain. The area in blue in these figures shows the effect with 32 dBW /MHz transmitter powers and the red shows the effect with 25 dBW/MHz transmitter powers

**Figure C.2 Field strength plot using ITU-R. P.1546**

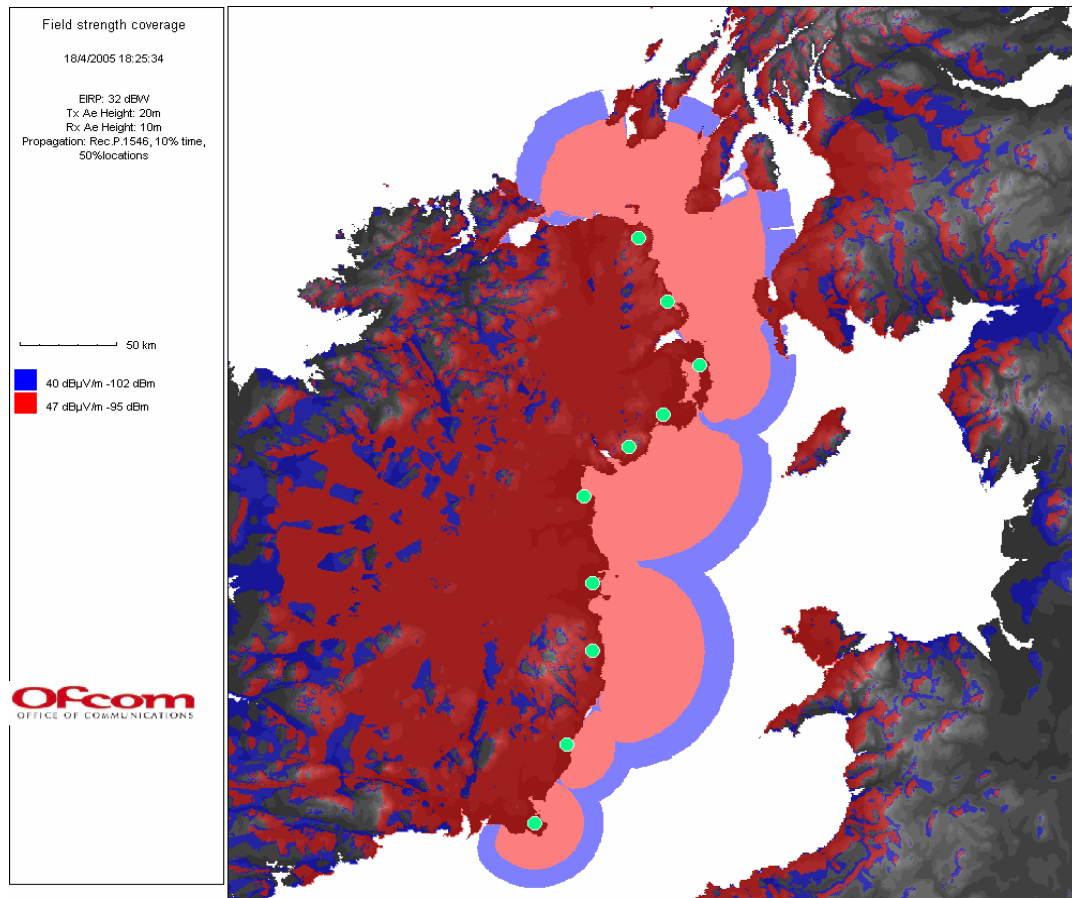
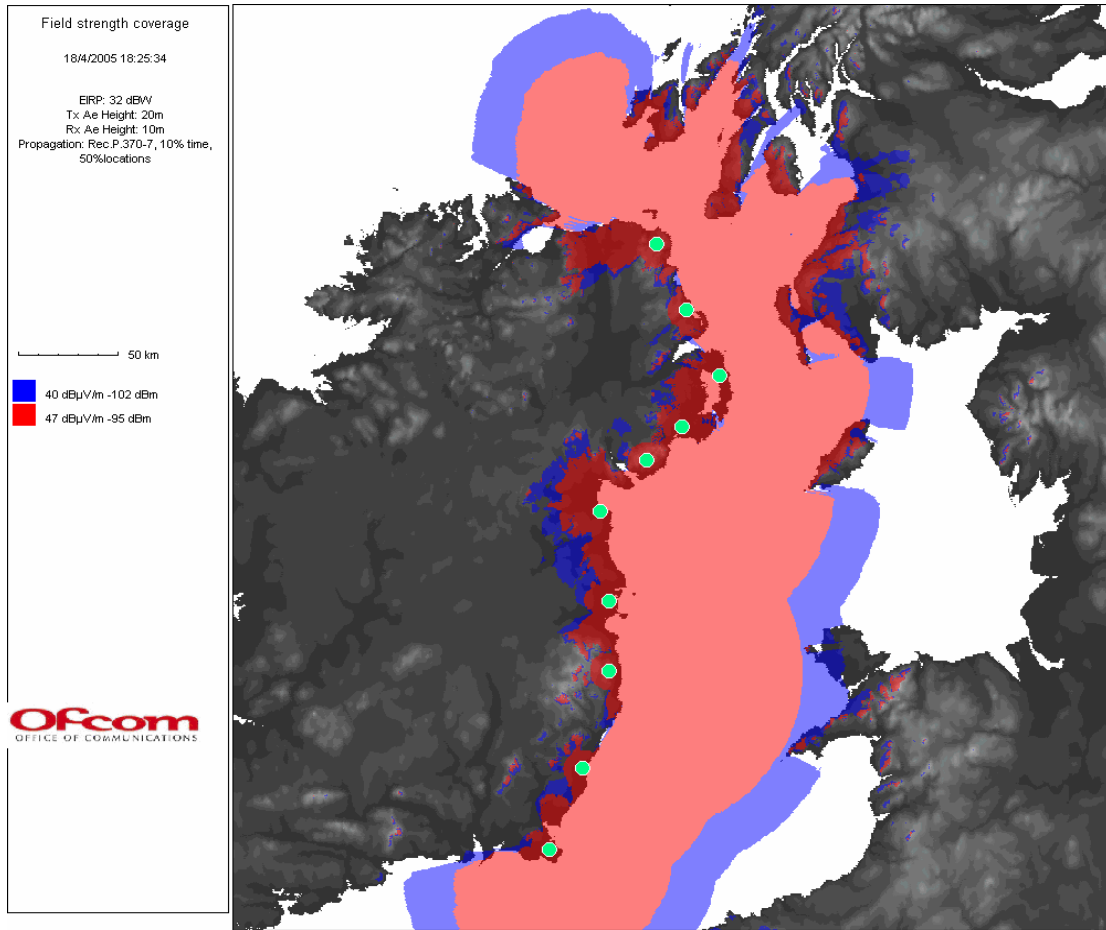


Figure C.3 Field strength plot using ITU-R Rec. P.370-7



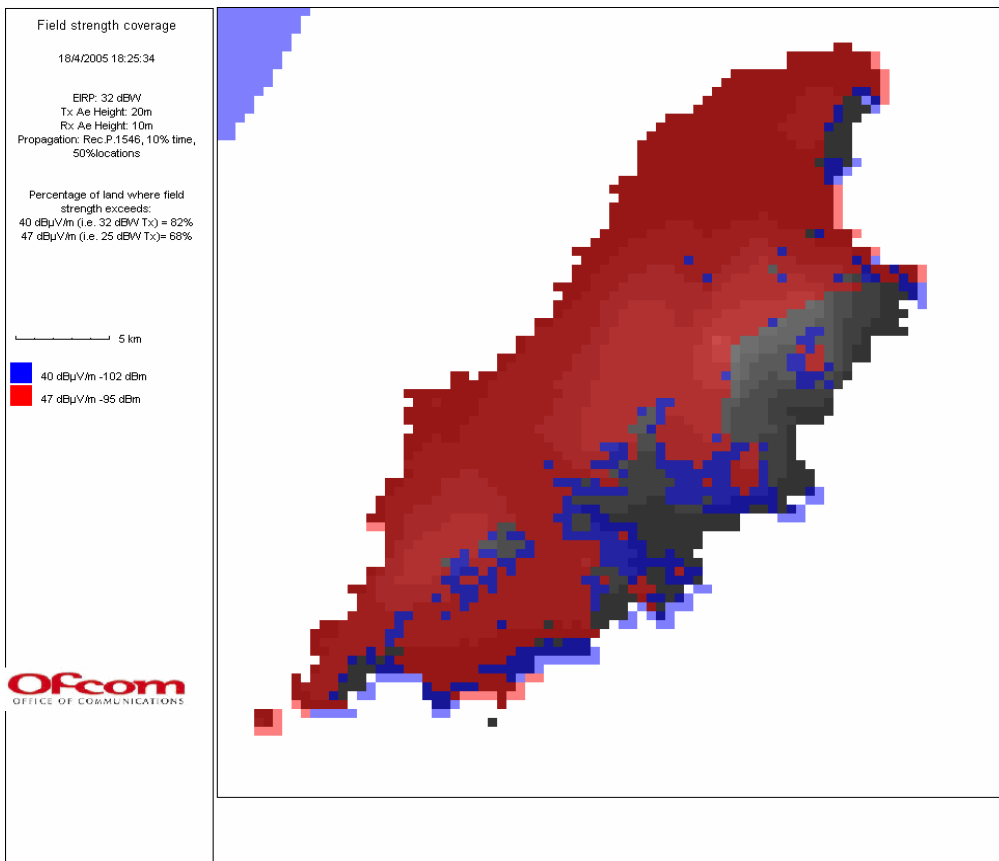
C.30 Using the receiver sensitivity for GSM1800 of -102 dBm/200 kHz the simulation for interference to the Isle of Man, in terms of percentage of the area of the Isle of Man, where the signal from the stations would exceed the receiver sensitivity level (RSL) is shown in table C.4 below.



**Table C.2 IoM % land covered**

EIRP (dBW)/MHz	% land exceeding where field strength exceeds -102 dBm/200 kHz	
	ITU-R P. 1546	ITU-R P. 370-7
25	68	41
32	81	56

C.31 Figure C.4 below shows the results of simulating the areas on the Isle of Man where the field strength received exceeds the RSL for GSM 1800 of -102 dBm/200 kHz using the propagation model ITU-R Rec. P. 1546. The simulation suggests that co-ordination of services would be required.



**Figure C.4 Field strength plot for the Isle of Man using ITU-R Rec. P.1546**

## Annex D

# Ofcom specific issues

## Introduction

D.1 In this Annex several issues specific to Ofcom are set out. These issues are as follows:

- Ofcom's consultation principles;
- relevant responses to Ofcom's Spectrum Framework Review: Implementation Plan consultation; and
- technical issues specific to Ofcom. The technical issues specific to Ofcom are:
  - Use of the spectrum by the military in Great Britain;
  - Spectrum Quality Benchmarks;
  - Requirements for site clearance; and
  - Ofcom's Sitefinder database.

D.2 This Annex does not include:

- Ofcom's Impact Assessment (see Annex E);
- Ofcom's functions and duties and the relevant UK legislation (see Annex F); and
- Ofcom's draft licence (see Annex G).

## Ofcom's consultation principles

D.3 Ofcom has published the following seven principles that it will follow for each public written consultation:

### Before the consultation

D.4 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

### During the consultation

D.5 We will be clear about who we are consulting, why, on what questions and for how long.

D.6 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened version for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

- D.7 We will normally allow ten weeks for responses to consultations on issues of general interest.
- D.8 There will be a person within Ofcom who will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. This individual (who we call the consultation champion) will also be the main person to contact with views on the way we run our consultations.
- D.9 If we are not able to follow one of these principles, we will explain why. This may be because a particular issue is urgent. If we need to reduce the amount of time we have set aside for a consultation, we will let those concerned know beforehand that this is a 'red flag consultation' which needs their urgent attention.

### **After the consultation**

- D.10 We will look at each response carefully and with an open mind. We will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

### **Other uses of the spectrum in the UK**

- D.11 In Great Britain, there is some military use of the spectrum of which potential licensees should be aware. In accordance with the UK Frequency Allocation Table, the Ministry of Defence ("MoD") operates transmitting earth stations at one or more of the following sites: Menwith Hill (Yorkshire), Oakhanger (Hampshire) and Colerne (Wiltshire) throughout the Spectrum Band and adjacent bands. Commercial operations in this band will have to accept any interference caused by these earth stations.

### **Spectrum Quality Benchmark (SQB) in Northern Ireland**

- D.12 The term Spectrum Quality Benchmark is used by Ofcom to denote the level of spectrum quality on which technical planning and coordination processes and criteria are based. These are usually captured within the Technical Frequency Assignment Criteria (TFACs) or alternatively, as in this case, in coordination guidelines. A discussion of SQBs can be found at:  
<http://www.ofcom.org.uk/radiocomms/ifi/trading/libguide/section4>

- D.13 The SQBs constitute guidance, not a guarantee, for licensees about the levels of interference that Ofcom expects are likely to be encountered from other licensed services. There is no guarantee for users that interference will not exceed the level implied by the SQB as, in practice, technical predictions are not completely reliable. However, Ofcom will continue to investigate and resolve interference complaints and will usually intervene where necessary to restore quality to the SQB.

- D.14 The development of SQBs to date has considered key interference mechanisms and other technologies and systems deployed in adjacent spectrum. These key mechanisms are discussed in more detail below.

### **Key interference mechanisms for SQBs in Northern Ireland**

- D.15 The SQB represents the level of unwanted emissions from other licensed sources that are allowed for by our spectrum planning models. In section 3, a coordination threshold level is proposed based on the parameters for the GSM 1800 system and two ITU-R propagation models from simulations using a proprietary spectrum planning

tool (see Annex C) This required the consideration of several key interference mechanisms.

D.16 It is proposed that spectrum quality benchmarks (SQBs) take into account a number of key interference mechanisms including:

- spurious emissions;
- receiver blocking;
- receiver interference performance;
- out of band emissions (including transients in some cases); and
- inter-modulation products.

### **The noise floor and spectrum occupancy**

D.17 Ofcom has carried out some spectrum monitoring across the Spectrum Band at various key locations throughout Northern Ireland. This provides some information, as a snapshot in time, on the noise floor in the Spectrum Band at each location. It will also provide an opportunity for testing the reliability and repeatability of spectrum occupancy and noise floor measurements so that changes in occupancy and the noise floor can be assessed from time to time. This historical information will be published alongside the Information Memorandum.

### **Site clearance in Northern Ireland**

D.18 It is generally a requirement of licences granted under the WT Act that radio transmitters considered to have significant potential to interfere with essential or safety of life systems, including aircraft, are assessed prior to installation and before they can be brought into use. This assessment is performed against the UK's Radio Site Clearance procedure based on location and technical information provided by the Site Clearance applicant. Details of the UK's Site Clearance procedure can be found in document OFW 191 at: <http://www.ofcom.org.uk/radiocomms/ifi/tech/ofw191.pdf>.

D.19 In Northern Ireland the UK's Site Clearance procedure will apply. A valid site clearance certificate, issued by Ofcom will be required for all Radio Equipment except stations which radiate not more than 17dBW ERP and where the highest part of the station, including antenna systems, is less than 30 metres above ground level and where the station, including the antenna systems, does not increase the height of an existing (site cleared) structure by 5 metres or more. For clarity, a 10 dBW transmitter at 45m above the ground would require clearance, as would a 24 dBW transmitter at 4m.

D.20 Relaxations of the thresholds for Site Clearance have been negotiated for particular station characteristics where these demonstrably reduce the risk of interference, for example a raised power threshold is applied in some bands for certain high gain antennas with narrow beam widths. Ofcom has also developed automated clearance tools for systems where the concerns arising from interference relate to well- defined interactions, for example lower-power satellite terminals deployed around airfields.

## Register of licences and Sitefinder

- D.21 As set out in Ofcom's Statement on Spectrum Trading (6th August 2004)<sup>12</sup>, in order to support spectrum trading and efficient spectrum management, Ofcom will publish as much relevant information as it can about radio licences. In so doing Ofcom will address concerns raised by respondents to that consultation on issues of security and commercial sensitivity.
- D.22 In December 2004 Ofcom made the Wireless Telegraphy (Register) Regulation 2004, which enabled Ofcom to establish a register of relevant information. Section 170 of the Communications Act makes a provision for Ofcom to establish such a register. The regulations extend only to those licences which are currently tradable and has been realised in the form of an on-line database which is available at [www.ofcom.org.uk](http://www.ofcom.org.uk)
- D.23 Ofcom intends to extend the scope of this register to include the licence which is the subject of this proposed award. Currently the Register of Licences provides basic information about licensees such as names, contact details, class of licence, the band(s) of frequencies and where relevant the geographical area of operation. It does not provide precise details about individual transmitters. This limitation reflects some of the concerns raised in previous consultation about providing more detailed information.
- D.24 Ofcom would like to move towards providing more information by widening the information it publishes. However, Ofcom needs to strike a balance between safeguarding the security of existing licence holders and providing information to potential new licence holders and those who want to trade. Ofcom also intends to invite the licensees in Northern Ireland to participate on a voluntary basis in providing information about their base stations for inclusion on Sitefinder database.

## Ofcom's Sitefinder database

- D.25 Sitefinder is the UK's national database of mobile phone base stations. It was established in response to one of the recommendations of the Group of Independent Experts led by Sir William Stewart which investigated possible hazards posed by mobile phone technologies on behalf of the Government and which reported in May 2000. The Group recommended that reliable and openly available information about the location and operating characteristics of all base stations should be provided by Government. Sitefinder fulfils this recommendation.
- D.26 The database provides information on all operational GSM, UMTS and TETRA base stations in England, Scotland, Wales and Northern Ireland. Indoor sites in public places such as airports, shopping centres and railway stations are included. The database is provided in the form of an internet website (<http://www.sitefinder.radio.gov.uk/>) utilising a map driven interface which allows users to see graphically the position of base stations nearest to any location of interest. Brief technical details of each base station can be obtained by clicking on the base station's icon on the map.
- D.27 Sitefinder relies on operators voluntarily providing Ofcom with detailed information about each of their sites on a regular basis (currently this is approximately every quarter). The type of information supplied includes:

- 1.1 <sup>12</sup> [http://www.ofcom.org.uk/consult/condocs/spec\\_trad/statement/sts.pdf](http://www.ofcom.org.uk/consult/condocs/spec_trad/statement/sts.pdf). The Trading Regulations are published by OPSI and available at [www.opsi.gov.uk](http://www.opsi.gov.uk).

#### **Award of available spectrum: 1785 - 1805 MHz**

- the transmit power (dBW); location (in the form of a 10 digit NGR and a postcode);
  - height of the antenna above ground level (m);
  - the frequency band of operation; and
  - the technology deployed.
- D.28 Ofcom has asked the Government for its views on the relevance of Sitefinder to potential licensees. The Government has advised that it continues to view Sitefinder as an important resource for consumers. Provision of information about the location of base stations is useful in the planning system, but also helps to inform the public and encourage discussion about mobile technology based on factual evidence.
- D.29 The Government has also advised that it considers that the holder of the licence in the Spectrum Band who uses one of the technologies currently covered by Sitefinder should be invited to participate voluntarily in the database.
- D.30 Consistent with this advice, it is therefore Ofcom's intention to invite the licensee in Northern Ireland to participate on a voluntary basis in providing information about their base stations for inclusion on Sitefinder where it uses one of the technologies currently covered. It is possible that the Government might in future seek the agreement of licence holders, including in this spectrum, to expand the scope of Sitefinder to include technologies beyond those currently included.
- D.31 Noting that detailed information on networks will be available through Sitefinder, albeit on a voluntary basis, Ofcom would welcome views as to the nature and detail of information that should be provided by the Spectrum Register in relation to licences in this award.

#### **Summary of relevant responses to Ofcom's SFR:IP**

- D.32 This annex sets out a summary of responses to Ofcom made to the Spectrum Framework: Implementation Plan which may be relevant to the spectrum award. Ofcom consulted on the SFR:IP in January 2005. In the Interim Statement on the SFR:IP, Ofcom stated that it would bring forward detailed proposals for each award in due course, and that it would take into account responses received to the SFR:IP in formulating these proposals.
- D.33 Ofcom's wider principles for spectrum management, as set out in particular in the SFR and SFR:IP, suggest that, in general, decisions on how spectrum is used should be left to the market rather than determined by the regulator. However, spectrum needs to be 'packaged' in some way in order for Ofcom to make it available to the market. It is important that this is done in a way that facilitates efficient use, as benefits from use of the spectrum are likely to be maximised if it can be used efficiently from the outset.
- D.34 In order to achieve this, Ofcom needs to have an understanding of the most likely uses of the spectrum, and to consider how this can be reflected in the packages offered to the market. Possible uses of the spectrum are considered in section 5.
- D.35 The proposals set out in this document have been prepared in light of the objectives identified for the award and in light of Ofcom's statutory duties. They take into account all the relevant evidence that is available to Ofcom, including the outcome of the consultation on the SFR:IP.

## Technology neutrality

- D.36 As set out elsewhere (see in particular: SFR, SFR:IP and Liberalisation Statement) and consistent with its statutory duties, Ofcom's preferred approach is to remove restrictions in existing wireless telegraphy licences that are no longer proportionate or objectively justified, enabling users to make better use of the spectrum and to introduce a wider range of services and technologies. Equally, when granting new wireless telegraphy licences Ofcom is of the view that, since technologies can change and develop over time, any prescription about the permitted use of the spectrum must be justifiable and proportionate. Ofcom does not wish to constrain future use of spectrum by being unnecessarily prescriptive in licence terms, where this is not necessary for spectrum management reasons. This suggests being as non-prescriptive as possible in licences about the permitted use of spectrum.
- D.37 Ofcom considers that this approach is also supported by the fact that the Framework Directive requires that national regulatory authorities take the utmost account of the desirability of making regulations technologically neutral. As a consequence, Ofcom is required in section 4 of the Communications Act 2003 to meet a number of duties relating to "community requirements". One of these is a requirement to act in a technology neutral way.
- D.38 Consistent with this general approach, Ofcom intends to release unused bands to the market with only those technology and usage restrictions that are the minimum necessary for the efficient management of the radio spectrum and the avoidance of interference, and compliance with Ofcom's statutory duties and international obligations.
- D.39 Ofcom's technical analysis, highlighted in section 6 and discussed in more detail in Annex C, indicates that it is not necessary to place any technology or usage restrictions on the Spectrum Band other than a maximum power level (per carrier), and a limit on out-of-block unwanted emissions. In particular, Ofcom has analysed the impact of deploying a number of typical systems on a typical narrowband system (based on GSM 1800). Ofcom therefore does not consider that it is necessary to specify the use of any one technology over any other.
- D.40 A small number of respondents to the SFR:IP, and also to Ofcom's consultation on the award of available spectrum:1781.7-1785 MHz paired with 1876.7-1880 MHz (see: <http://www.ofcom.org.uk/consult/condocs/1781/>), specifically certain existing mobile network operators (MNOs), have expressed the view that the flexibility allowed by technology and application neutral licences which would allow mobile use in new spectrum licences would be unduly discriminatory. Ofcom does not believe that this would be the case and the issue is discussed below. Ofcom believes that the proposed conditions meet the statutory requirements, set out in section Annex F, in particular the requirements only to impose terms that are objectively justified, non-discriminatory, proportionate and transparent.
- D.41 In setting the terms of the licence, Ofcom has taken into account the available technical and economic evidence on the likely use of the Spectrum Band and believes that these terms represent those necessary to ensure efficient use of the radio spectrum and therefore they are objectively justified. As set out elsewhere in this document, Ofcom considers that specifying high power use, but facilitating low power use is likely to ensure the most efficient use of the Spectrum Band and on the basis of the analyses carried out its view is that the power limit of 56 dBm per MHz per carrier and the emission mask with a limit for out of block unwanted emissions of -126 dBm



per 100 kHz represent the requirements which are likely to allow the most efficient low power uses to develop.

- D.42 The initial licence term specified of 15 years is appropriate for services likely to be deployed, in particular as it gives the licensees sufficient security of tenure to invest, based upon the available evidence of the likely time such businesses may require to earn a return on their investment, while preserving Ofcom's discretion on notice to revoke the licence for spectrum management reasons, after the initial term, if it becomes necessary to do so. The proposed provisions on licence fees are objectively justified because they will either be determined by the bidders themselves in the auction or if, as indicated above, following the expiry of the initial term other licences fees are payable, these will be required to ensure continued efficient use of the Spectrum Band or to recover a share of the regulatory costs.
- D.43 Ofcom also believes that these licence conditions are proportionate since they are, in Ofcom's view based on the evidence available, the minimum set of restrictions which are required to promote efficient use of the Spectrum Band and the promotion of competition. The proposed licence terms are also transparent in that they are clear as to the purpose in each case and will be set out in the licence, a draft of which is included in Annex G.
- D.44 Ofcom has also considered carefully whether the proposed licence terms will discriminate unduly against any other person, including existing licensees in other spectrum. Ofcom considers that the proposals do not involve undue discrimination. The reasons for this are discussed in more detail below, alongside discussion of a number of other points made by the mobile network operators.

### **Comments by mobile network operators on undue discrimination and certain other matters**

- D.45 The MNOs commented in some detail in response to the SFR:IP consultation, and in some cases commented on matters that would be relevant to the licensing of the Spectrum Band. The proposals in this document are for a licence in the Spectrum Band that is technology and use-neutral, has an indefinite duration, and does not contain roll-out obligations. This document also proposes to extend spectrum trading to the Spectrum Band.
- D.46 In the SFR:IP consultation, Ofcom set out its views in relation to the potential release of 8 MHz of spectrum at 1790-1798 MHz. At the same time Ofcom recognised that there might be commercial incentives to deploying all-Ireland wireless networks, and said that it had raised the possibility with ComReg, the Irish regulator, of jointly awarding spectrum in this band for use in Ireland and Northern Ireland.
- D.47 The MNOs commented in varying degrees of detail on the 1790-1798 MHz band. O2 commented that the auction of this spectrum was not a priority (before 2007/08), and that various conditions should be met before the auction should proceed. O2 also suggested that the licences must include a moratorium on trading and liberalisation to 3G, unless Ofcom had previously decided to make such a facility available to all 2G licensees by the same time. O2 also suggested that if the licences were made tradable, the existing 2G licences should be made tradable, and that if new licences have an expectation of becoming rolling licences (i.e. with an indefinite duration), this should also apply to existing 2G licences.
- D.48 The respondents who supported an early award of the 1790-1798 MHz band before 2007/08 were BT, Bytel, CMA, Oak Global and the Wales Broadband Stakeholder



Group. Of these, most identified that an increase in the spectrum available from 8 MHz to 15 or 20 MHz (e.g. increase from 1790 – 1798 MHz to 1785 – 1800 MHz or 1785 – 1805 MHz) was also desirable. Oak Global identified the difference between the constraints in Great Britain and Northern Ireland and CMA wanted to see encouragement for the creation of widest possible (e.g. all -island) markets. On the other hand, neither Vodafone nor T-Mobile believed that the release of the 1790-1798 MHz band was a priority.

- D.49 Orange identified the use of the band by the Home Office and Scottish Office (HO/SO) links for emergency services and said that the consideration of migration issues should not take priority over the resolution of the new framework for spectrum management. O2 said it would like to see protection for the incumbent (HO/SO) use as well as protection to potential users including those in neighbouring bands. They also said that they wanted Ofcom to spell out when and how it planned to make an award – they wanted to understand Ofcom’s views on a number of legal and regulatory issues surrounding the award of licences.
- D.50 Hutchison made a number of comments that were generic to spectrum awards. Firstly they argued that the benefits of harmonisation of particular bands should be considered further. Secondly Hutchison argued that the design of auctions and spectrum packaging in relation to potential pairings or other packaging of spectrum should be objective, transparent and fair.
- D.51 Hutchison’s third point concerned speculative acquisition of spectrum (hoarding and windfall gains) and timing for the release of unused spectrum from the point of view of the consumer. Hutchison sought clarification of whether competition law is likely to be effective in dealing with the adverse consequences of these situations. O2 raised similar concerns.
- D.52 The next two points made by Hutchison dealt with the competitive neutrality of future award not having an adverse effect on investment incentives and the impact of ‘toe-holds’ on spectrum packaging and auction design.
- D.53 The final issue raised by Hutchison concerned technology neutrality and the potential for interference arising from differences in fixed and mobile use of spectrum. Vodafone said that there are potential interference problems with 1790-1798 MHz as it is immediately adjacent to the 2G band. Further they stated that a TDD system would cause interference to Vodafone and O2 and be interfered with by Orange. In particular they said that the GSM 1800 specification for blocking of terminal receivers does not envisage high power signals close to the [GSM 1800] downlink band.
- D.54 T-Mobile commented on the release of new spectrum that would allow 3G services to be provided at this juncture. It observed that this would be highly discriminatory as new spectrum would be available without any roll-out obligations, and as the release would occur while the existing 2G licence holders were not permitted to use their 2G spectrum for 3G use. T-Mobile also suggested that any spectrum licences offered to the market before 2012 should contain an explicit prohibition on the provision of 3G services until the end of 2012, as by this period the current 3G operators would have had an opportunity to recoup their investment in licence fees and infrastructure.
- D.55 Orange and Vodafone commented in less detail on issues that might be raised by the award of licences. Vodafone suggested that the award of new licences should contain (for a defined period) restrictions on their use for 3G services.

- D.56 Ofcom has considered these comments carefully. Ofcom has addressed the issue of the timing of this award process, and notes that the spectrum is presently unused in Northern Ireland, but that it may be of substantial value if brought to productive use, and that there is some evidence of demand. Ofcom considers that the suggestion that the award process should be further delayed, is inappropriate and inconsistent with Ofcom's statutory duties.
- Regarding the concern about undue discrimination, Ofcom considers that undue discrimination can only arise where different treatment is given to persons in similar circumstances, or where the same treatment is given to persons in different circumstances, and there is a lack of objective justification for the treatment given. Ofcom does not consider that the proposals in this document for licensing the Spectrum Band involve any undue discrimination against the holders of 2G and 3G licences, or any other existing licence. This is because the terms of the licence that Ofcom proposes to offer in the Spectrum Band are objectively justified, and there are a number of differences between the licence available in the Spectrum Band and the existing 2G and 3G licences.
- D.57 These differences include the quantity of spectrum available, its status in relation to international harmonisation measures and its geographical scope.
- D.58 It is also relevant that the 2G and 3G licences differ in some respects from each other. As discussed in detail in the SFR:IP, the licences differ in relation to term and the conditions allowing revocation. The licences also differ from each other in relation to the conditions under which they were awarded. They have different provisions as to the permitted technologies and types of use, and the payment of fees. Ofcom has discussed these differences at some length in the SFR:IP, and has noted that they raise a number of complex issues that are *sui generis* to these licence classes.
- D.59 Given the many differences between the existing 2G licences, the existing 3G licences, and the licence proposed for the Spectrum Band, Ofcom does not consider that proceeding with its proposals for the Spectrum Band can discriminate unduly against the existing 2G and 3G licensees, or against any other person.
- D.60 The licence proposed for the Spectrum Band constitutes a different type or class of licence from those already that exist for 2G and 3G services, with rights that are different from and in some material respects inferior to the existing 2G and 3G licences. Ofcom considers that there can therefore be no undue discrimination against existing 2G or 3G licensees. Further, Ofcom is not proposing to place any restrictions on the holders of 2G or 3G licences (or for that matter any other person) from participating in the auction and competing to acquire the licence.

### **Responses to SFR:IP Consultation Document on the band**

- D.61 Ofcom's responses to the specific issues raised are set out in the following table, although it should be noted that the earlier sections of this document also contain Ofcom's responses for some issues.

**Table D.1. SFR:IP responses that may be relevant**

Issue raised	Comments	Ofcom's response
Licence conditions to require use of the spectrum	<p>Hutchison commented on speculative acquisition of spectrum (hoarding and windfall gains) and timing for the release of spectrum (unused spectrum) from the point of view of the consumer. Coffee Telecom proposed including conditions to prevent hoarding of spectrum.</p> <p>One respondent suggested that penalties should be imposed when the spectrum is under-used and rewards given when it is used properly.</p>	<p>Ofcom believes that neither a 'use it or lose it' condition nor measures relating to the quality of use would be appropriate in this award. Ofcom believes that the market mechanisms of the auction process itself and the scope for secondary trading will be more effective in securing optimal use of the spectrum than the suggested regulatory obligations. Furthermore such regulatory obligations may have unintended consequences which lead to sub-optimal decisions. Also concerns relating to spectrum hoarding can be addressed through Ofcom's competition powers.</p>
Downstream market regulation	<p>Hutchison sought clarification of whether competition law is likely to be effective in dealing with adverse consequences associated with use of spectrum. O2 raised similar concerns and argued that Ofcom should provide clarity on downstream market regulation (national roaming conditions, call termination market for the new licensees, general conditions of entitlement) before relevant awards.</p>	<p>It is the responsibility of prospective bidders to assess which regulations are relevant to the services they envisage offering and how they would apply. Ofcom is not in a position to decide on the application of the regulatory framework to services supported by the Spectrum Band before the licensee develops services. Ofcom has addressed the role of competition law in the context of its work on spectrum trading.</p>
Licensing process in the 1790-1798 MHz band	<p>One respondent suggested that one national licence be made available by Ofcom.</p>	<p>The proposed award of one licence for Northern Ireland has been designed, in the light of technical and market analysis, to facilitate as efficient an assignment as possible. The geographical scope and limitations on the number of licences are discussed in section 6.</p>
Timing of the award	<p>The respondents who supported an early (co-ordinated) award before 2007/08 were BT, Bytel, CMA, Oak Global and the Wales Broadband Stakeholder Group. On the other hand, neither Vodafone nor T-Mobile believed that the release of the 1790-1798 MHz band was a priority.</p> <p>Orange identified the use of the band by HO/SO links for emergency services and said that the consideration of migration issues should not take priority over the resolution of the new framework [for spectrum].</p>	<p>Ofcom believes that the band should be made available as soon as practically possible to promote the optimal use of the Spectrum Band and Ofcom, subject to the outcome of this consultation, plans to hold the auction by the end of 2006.</p>

**Award of available spectrum: 1785 - 1805 MHz**

<p>Restrictions on mobile use in new spectrum licences – differences in licence terms with 2G licences</p>	<p>T-Mobile commented on the release of new spectrum for 3G services at this juncture. It observed that this would be highly discriminatory as new spectrum would be available without any roll-out obligations, and as the release would occur while the existing 2G licence holders were not permitted to use their 2G spectrum for 3G use. T-Mobile also suggested it would be highly discriminatory and distort competition if holders of new licences would have liberalised rights and holders of 2G licences did not.</p> <p>Vodafone said that it did not favour restrictions in new licences relating to mobile use other than 3G but only if the existing 2G licences were put on the same footing: tradable; undated, subject to 5 years notice (with a minimum term where appropriate). To do otherwise would be discriminatory.</p>	<p>Ofcom does not consider the proposed licence terms for the award of the Spectrum Band to be unduly discriminatory. Undue discrimination can only arise if different treatment is given to persons in similar circumstances, or where the same treatment is given to persons in different circumstances, and there is a lack of objective justification for the treatment given. The differences between the proposed licence and existing 2G licences include the quantity of spectrum, its status in relation to international harmonisation measures, and its geographical scope. The provisions of the proposed licence in the Spectrum Band are moreover objectively justified. The licence for the Spectrum Band therefore constitutes a separate type of licence from the 2G licences.</p> <p>Ofcom does not believe that the proposed licence would lead to a distortion of competition and no explanation for how this could occur was provided by the respondents to the SFR:IP. Ofcom also notes that many of the potential uses of the Spectrum Band discussed in this document are potential sources of competition to services such as DSL-based fixed telecommunications.</p>
<p>Restrictions on mobile use in new spectrum licences – differences in licence terms with 3G licences</p>	<p>O2, T-Mobile and Vodafone commented that to award new spectrum licences that could be used to offer 3G services without roll-out obligations would be discriminatory and distort competition. T-Mobile also argued that the costs of meeting the obligations would take some time to recover and this would not be achieved before 2012. T-Mobile also commented that to award new spectrum licences which allowed the holders to obtain spectrum at significantly less cost than 3G licensees was discriminatory and would distort competition. O2 and T-Mobile also commented that to award new spectrum licences with an indefinite term compared with the fixed term of 3G licences would be discriminatory and distort competition.</p>	<p>Ofcom does not consider that the circumstances in which the proposed licences will be awarded are similar to those relating to the 3G licences and therefore the concerns expressed regarding discrimination are misplaced and moreover the terms of the proposed licences are objectively justifiable in relation to the Spectrum Band. As discussed above, Ofcom does not believe that the proposed licences would lead to a distortion of competition, including in relation to the services offered by the 3G licensees.</p>

Restrictions on mobile use in new spectrum licences – protecting investment by 3G licensees / recovery of costs

H3G commented that restrictions on mobile use should be included in new licences to avoid distorting investment incentives by existing 3G licensees. Vodafone made a similar comment that there was a significant risk that putting large swathes of spectrum onto the market would have a disruptive effect in an immature but growing market, and further this might have a long term impact if it prevented market reaching critical mass. A related point was made by T-Mobile who commented that it would be unable to exercise its right of establishment under Article 43 of EC Treaty if its investment in licence fees and infrastructure built in reliance on onerous licence terms (especially roll out obligations) are not protected. T-Mobile also commented that allowing persons other than the existing 3G licensees to offer 3G services would dilute the property in spectrum to which it is entitled and to do so before 2012 would prevent it from having a reasonable chance to recoup their investment and so restrict its rights to pursue a business activity.

Ofcom does not believe that these concerns are relevant to the award of the Spectrum Band. Even if it were the case (which remains unproven) that allowing the provision of mobile services in new spectrum could undermine investment in 3G services by the incumbents or hamper their ability to recover their costs, it is not clear how this could arise given the characteristics of the Spectrum Band. Moreover, Ofcom considers that release of the Spectrum Band is strongly in the interests of citizens and consumers, as it will facilitate use of the spectrum (which is presently un-used in Northern Ireland), and thereby promote the provision of additional electronic communications services, with potential benefits for competition and innovation.

**Award of available spectrum: 1785 - 1805 MHz**

<p>Restrictions on mobile use in new spectrum licences – change to 3G auction position</p>	<p>Orange commented that restrictions needed to be maintained for a transitional period (not specified) as business cases of existing 3G licences were based on regulatory environment described in the 3G auction and consequent number of competitors which is now being undermined by Ofcom.</p> <p>T-Mobile raised similar concerns suggesting that the statements at the time of 3G auction gave a legitimate expectation that market condition applicable at the time would remain stable.</p> <p>Vodafone made similar comments on the need to take full account of the implications of previous regulatory decisions in the 3G auction.</p> <p>H3G also commented that it was premature to be changing the regulatory framework established at the time of the 3G auction. It stated that it does not believe there are potential benefits which could be achieved that would outweigh the costs.</p>	<p>Given Ofcom's comments in relation to the points above regarding the difference in licence terms with 3G licences and the 3G investment issues, Ofcom does not consider that these concerns are relevant to this award.</p>
<p>Restrictions on mobile use in new spectrum licences - lack of market analysis</p>	<p>Orange commented that Ofcom had not set out its market analysis justifying its view that to include restrictions on the use of spectrum for mobile services would lead to a loss of competitive stimulus.</p>	<p>Ofcom does not believe that it is necessary to set out a specific empirical market analysis to justify this point since it seems clearly to be the case that the imposition of entry barriers (which would be consequence of imposing a restriction) would be likely to lead to less rather than more competition.</p>
<p>Award of further spectrum which can be used for 3G is unnecessary</p>	<p>All MNOs commented to varying degrees that there was no scarcity of spectrum for 3G at present nor was there likely to be on timescales indicated by Ofcom for the award of more spectrum and therefore it would be inefficient to award more spectrum on timescales proposed in the SFR:IP.</p>	<p>As a matter of general policy as set out in the SFR, SFR:IP and SFR: IP Interim Statement Ofcom has explained that it has a general preference for a market based approach to spectrum management. Consistent with this is the view that it is unlikely to be the case that a policy of specifically holding back the release of spectrum until there is "proven demand" is likely to lead to efficient use. In any case in this award there is clearly some demand for the spectrum (as evidence by the responses to the SFR:IP) and Ofcom sees no justification for delaying the award.</p>

<p>Linkage with 2G liberalisation</p>	<p>O2 commented that a clear statement on future liberalisation of both current 2G and 3G licences is a pre-condition to future 3G auctions (which it defined to include any award which did not preclude 3G use) given the previous administrative statements. It also made a similar comment that the failure to address issues relating to 2G re-farming and the availability of all substitutable IMT-2000 spectrum before awarding new spectrum would be contrary to administrative practice as set out in HM Treasury's Green Book and lead to inefficient assignments.</p>	<p>Ofcom does not believe that a resolution of the issues of 2G liberalisation nor establishing a policy on the removal of usage restrictions in the 3G licences are pre-conditions to this award. The rights being awarded to the Spectrum Band are distinct from existing 2G and 3G rights, and are objectively justified.</p> <p>Ofcom does not consider that there are any previous statements which would require it to address the issues of 2G liberalisation before proceeding with this award and believes that its approach is consistent with its statutory duties.</p>
<p>Priority to release spectrum early with access for all of Ireland and open more contiguous spectrum</p>	<p>Release of band before 2007/08 with all-Ireland licences and an increase in spectrum from 8 MHz to 15 or 20 MHz (e.g. increase from 1790 – 1798 MHz to 1785 – 1800 MHz or 1785 – 1805 MHz)</p> <p>Support for an early (co-ordinated) award from BT, Bytel, CMA, Oak Global and the Wales Broadband Stakeholder Group.</p> <p>Oak Global identified the difference between the constraints in Great Britain and Northern Ireland and CMA wanted to see encouragement for the creation of widest possible markets.</p>	<p>Ofcom's assessment is that an award of 20 MHz of unpaired spectrum in Northern Ireland is likely to be beneficial to consumers in Northern Ireland and the Republic of Ireland.</p> <p>The proposed terms and conditions of this award are set out in this document.</p>

## Annex E

# Ofcom's Impact assessment

- E.1 In this section we evaluate the relative economic benefits of the following options for the award of licences:
- Co-ordinated: A co-ordinated award of licences in Ireland and Northern Ireland in 2006 followed by GB award in 2007/08;
  - all UK: Ireland award in 2006 and a later all UK award in 2007/08;
  - separate and unco-ordinated awards in Ireland and Northern Ireland: Three separate awards are assumed to be made as follows: in Ireland in 2006, Northern Ireland in 2006 and GB in 2007/08.
- E.2 Ofcom has taken the third option (separate awards) as the baseline and assesses economic impacts relative to this baseline. Economic impacts need to be considered from both a consumer and an operator perspective. In both cases the impacts are uncertain as they depend on who wins licences in the various award processes and the services they wish to supply.
- E.3 Analysis shows that there is a chance that the same operator may not win licences in the north and south of Ireland. This complicates the comparison of the co-ordinated award option with the other two options as the issue of whether or not to include the benefits from a single supplier providing a service needs to be considered. The approach adopted has been to present the benefits assuming one supplier, otherwise this option becomes indistinguishable from the third option of Separate Awards, and to recognise that this approach overstates the benefits because there is a chance that the benefits gained by having a single licensee will not be realised with the co-ordinated award outcome.
- E.4 The analysis also focuses on the deployment of a broadband wireless access ("BWA") solution, as this appears to have the highest economic value from the evidence available to Ofcom. However, the award is proposed to be technology – and service – neutral, and other services (such as CCTV and wireless microphones) may use the spectrum as well as, or instead of, BWA. Ofcom has seen no evidence to suggest that this would change the central conclusion of the impact assessment, namely that a co-ordinated award should proceed as quickly as feasible.

## Consumer impacts

- E.5 The award options could differ in terms of the number of consumers that may access the service, the cost of services, the timing of when services might be enjoyed, and service functionality.

## Numbers of consumers

- E.6 Differences in the number of consumers that may access the service arise under the co-ordinated award outcome (relative to the separate awards option) if consumers in the border areas can be served as a result of a single operator offering a new service. However, if the new service is not available, households would still have the option of using an alternative (e.g. DSL) service in Northern Ireland and possibly a service in the south (e.g. FWA, FWLA or DSL). For those consumers, for whom these alternative services are less preferred, there will be some (possibly small) loss of consumer



benefit. In the case of business users choosing the service and if this new service offers mobile broadband, there is the possible alternative of using 3G services in border areas. This suggests that for business users there could be a more substantial benefit from the co-ordinated award option as compared with the separate awards option.

- E.7 Under the all UK option, consumers in Northern Ireland could have a significant delay before receiving services relative to either of the other two options. However, in this time it can be expected that other wireless-based alternatives to DSL may have launched a broadband wireless service in Northern Ireland, possibly in 2009 implying a 2-3 year delay in the provision of BWA services to Northern Ireland. Modelling by Quotient and Indepen assumes this has no impact on the overall take-up of broadband services – consumers opt for an alternative (less preferred) service – though again there will be some loss of benefit since some consumers will have to use a less preferred service. There could also be a more substantial loss of benefit to business users (as described above).

### **Costs of supply**

- E.8 Costs of supply could differ between the options as a result of differences in the costs of procuring network equipment. The work by Quotient and Indepen suggests that a co-ordinated award outcome could offer cost savings of 3.8% on capital expenditure in Northern Ireland relative to two separate licences. Cost savings in Northern Ireland are likely to be even larger in the case of an all UK licence because of the higher volumes, however, the late start to this service means it will be at best a niche operation. In fact it seems more likely that the service will be eclipsed by other BWA that may be offered in the UK suggesting that the cost savings could be highest under the co-ordinated award outcome.

### **Delays**

- E.9 Delays in service provision only affect those services provided in Northern Ireland. Delays to 2007/08 or later are likely to mean that consumers will choose a less preferred broadband service and that other broadband services largely capture the potential market for the new service in Northern Ireland. Delays could also affect the degree of competition in the broadband market in Northern Ireland. The extent of these impacts depends in part on the number of competing suppliers. Ofcom believes that these impacts are likely to be small. In the case of mobile services there are five 3G operators in the market and in the case of fixed broadband there are two competing infrastructure providers in the main urban markets in Northern Ireland, and other retail suppliers using wholesale broadband products. Only a small market share is forecast for the new service which suggests its impact on competition in the broadband market will not be large. We therefore conclude that the main cost of delay under the all UK option is the cost to some consumers arising from the reduced choice of broadband suppliers.

### **Service functionality**

- E.10 Under the co-ordinated award option, consumers in the north and south of Ireland may gain the benefits of roaming while under the all UK option consumers in Northern Ireland would have the option of roaming to the rest of the UK, though not until 2007/08 or later. However, it is also possible that these benefits could be achieved if the same operator happened to win licences in Great Britain and Northern Ireland (under the co-ordinated award option) or won the UK and Ireland licences (under the all UK option). There are strong commercial incentives to provide roaming, so it may

be provided commercially under any scenario. There are also alternative commercial providers of this functionality for consumers (including 3G and Wi-Fi).

### Operator impacts

E.11 Operator benefits are measured by the differences in operator profits between the options. These differences arise from differences in costs (assuming these are not passed on to the consumer) and differences in service take-up. These impacts are already considered above and so should not be counted again here.

### Conclusions

E.12 Table E.1 summarises the impacts discussed above and gives a qualitative indication of their scale. Overall we believe that the co-ordinated award outcome offers a potential net economic benefit as compared with the other two options considered. The benefit relative to the separate awards option arises from the potential synergies in offering a co-ordinated service and the benefit relative to the all UK option arises from the increased consumer choice in Northern Ireland in the period 2006-2009/10.

**Table E1. Benefits and costs of award options**

	co-ordinated award vs separate awards	All-UK vs separate awards
Benefits	<p>Consumer benefits of increased choice.</p> <p>Lower costs for service provision in Northern Ireland.</p> <p>Small potential benefit associated with provision of roaming.</p>	<p>Possibly lower costs in Northern Ireland, though delays in award could mean the service may not be provided.</p> <p>Small (if any) roaming benefit.</p>
Costs	None	Reduction in consumer benefits due to delay of choice of services in Northern Ireland

### Options for the award of the spectrum

E.13 Ofcom is proposing to award this spectrum by means of an auction. It is also proposing that one licence is awarded and that this licence is technology neutral.

Ofcom has gone through a number steps in making this proposal and has carefully considered the options for each of the following steps:

- how should the spectrum be licensed, including the option that the spectrum is not licensed
- should use of the spectrum be made technology neutral or technology specific
- if licensed, should the spectrum be awarded by auction or some other process
- if auctioned what auction format should be chosen

E.14 A summary of the options Ofcom has considered for each steps is set out below focusing on the costs and benefits to consumers, businesses and Ofcom.

### Spectrum licensing

E.15 The options that Ofcom has considered for licensing the spectrum are as follows:

- the spectrum is unlicensed
- one licence is granted for the spectrum band
- two licences are granted for the spectrum band

	<b>Costs</b>	<b>Benefits</b>
Unlicensed	<p><i>Business:</i> There is a high risk that spectrum users suffer interference because of the high power that may be used in the band. This could seriously damage market potential, e.g. the quality of unlicensed BWA services would be far inferior to other broadband services which do not suffer interference problems.</p>	<p><i>Businesses:</i> Businesses avoid licence fees and cost of participating in an award process</p> <p><i>Ofcom:</i> Avoid initial costs of awarding spectrum and ongoing licensing administration costs.</p>
One licence	<p><i>Consumers:</i> Potentially less choice and competition than under a multiple licence approach, although pressure for competition is likely to come from existing technologies and platforms.</p>	<p><i>Businesses and consumers:</i> Issuing one licence allows a technology and service neutral approach. A wider range of potential uses is facilitated by the technology neutral approach, which potentially benefits both business and consumers.</p> <p>It is difficult to predict what the most efficient use of the spectrum is, therefore a technology neutral approach is more likely to maximise the value of the spectrum, than a technology specific approach.</p>

**Award of available spectrum: 1785 - 1805 MHz**

<p>Multiple licences</p>	<p><i>Businesses and consumers:</i> If the spectrum is divided in two (or more), each licence will not have enough spectrum to allow most technologies to operate. There would be a large reduction in the flexibility of spectrum usage, and increase in complexity. It is possible that only low power applications would be able to operate in this scenario. Businesses wanting to use other technologies, and the consumers they would serve, would lose out.</p> <p>Ofcom believes that this option is unlikely to lead to efficient spectrum use, because it could prevent the use of some technologies. Moreover, the more licences, the greater the number of guard bands, therefore the less likely it is that the outcome is efficient.</p> <p>In the event that one licence were awarded, but it was in fact more efficient to have multiple licences, trading could help achieve that outcome, although transaction costs may limit its effectiveness.</p>	<p><i>Consumers:</i> More providers will increase choice and in theory competition if the spectrum is used to serve consumers. Competition benefits may be small, however, if there is competition with existing service platforms and technologies, and zero if additional competition is prevented by reducing the utility of the spectrum.</p> <p><i>Businesses:</i> One additional business can acquire a licence, but this is limited to specific technologies. Those wanting to use the spectrum for other technologies would not be able to acquire the spectrum, therefore it is difficult to judge whether there is any net benefit for business in this option.</p> <p><i>Businesses and consumers:</i> Auction design could allow the market to choose between one licence and multiple licences, however the additional complexity and risk of auction failure would not seem to compensate for the mild potential increase in competition.</p>
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E.16 Ofcom’s assessment is that the best option is to issue one licence for the spectrum band. Although making the spectrum unlicensed would remove the burden of paying licence fees from users, and reduce some administrative costs, the interference that is likely to result would severely restrict the quality and viability of services that could be provided.

E.17 Issuing one licence is also preferable to issuing multiple licences because it enables the licence award to proceed with maximum flexibility and full technology and service neutrality (itself discussed in the next section). Ofcom’s research has shown a high degree of uncertainty over which technologies and services will deliver the optimal value of the spectrum, therefore technology and service neutrality are particularly important in this award.

**Technology neutrality**

E.18 Ofcom is proposing that the licences awarded are technology and service neutral. Ofcom has also considered the alternative of making these licences technology and service specific. A summary assessment of the impact of both two options is shown in the table below.

	<b>Costs</b>	<b>Benefits</b>
Technology and service neutral	<p><i>Businesses:</i> Costs to business should be limited to assessing the whether the technologies and services they want to offer are compatible with the spectrum mask as defined by Ofcom.</p> <p><i>Ofcom:</i> Designing a technology and service neutral award is more complex, but the additional costs involved are small in relation to the overall cost to Ofcom of designing and running the award process.</p>	<p><i>Businesses:</i> Potentially more businesses are able to participate in the award process.</p> <p><i>Consumers:</i> The market is better placed to determine the optimal services and technologies that can be used in this spectrum. There is a lot of uncertainty over the potential uses of this spectrum band which increases the benefits of allowing the market to choose. Consumer welfare is also likely to be greater by allowing greater flexibility over technologies and services.</p>
Technology and service specific	<p><i>Businesses:</i> Businesses are restricted in technologies they can use and some may be prevented from participating in the award process.</p> <p><i>Consumers:</i> Given the uncertainty over the optimal use of the spectrum, there is a high probability that efficiency will be lost and consumer welfare reduced by restricting the services and technologies which are allowed.</p>	<p><i>Businesses:</i> The spectrum can be packaged more closely to the needs of the specified technology or service.</p> <p><i>Ofcom:</i> Likely to be simpler to define technical characteristics than a more flexible approach.</p>

E.19 The impact assessment shows that a technology and service neutral policy is the better option. The costs of this approach appear to be modest, and allowing greater flexibility over technologies and services is much more likely to lead to an efficient outcome for the award.

### **Format of the award process**

E.20 Ofcom set out its general policy on the award of spectrum in the Spectrum Framework Review: Implementation Plan (SFR:IP) consultation published in January 2005. This document set out Ofcom's plans for the future award of spectrum including this spectrum band. It considered three options for awarding spectrum: auctions, comparative selection and first come first served. Ofcom concluded that, in general, auctions were the best mechanism for awarding licences where the nature of the spectrum available indicated that demand was likely to exceed supply. Where this was the case, auctions were most likely to lead to the assignment of the spectrum to the uses and users which valued it most highly.

E.21 Ofcom and ComReg have carried out research into the potential demand for this spectrum and has identified a wide range of potential uses for the spectrum which are discussed in the main body of the consultation. The research also canvassed the potential demand for the spectrum. Though this only gives an indicative view of

demand, because the likelihood of participating in an auction may be overstated when no commitment is required, Ofcom's research did show that that demand appears to outstrip supply.

E.22 Ofcom, therefore believes that its assessment in the SFR:IP also applies to this spectrum band and that an auction is the best option for awarding the spectrum.

### **Auction format options**

E.23 Analysing the options for auction format is complicated by the potential synergies that may be available to an operator wishing to operate both Northern Ireland and Ireland. This means that bidders wanting to exploit these synergies could face possible aggregation risks - i.e. there is a risk that a firm which only wins one licence could end up stranded having overpaid for it because their bid included part of the premium they expected from holding both licences. An appropriate way to deal with this issue would be to have a combinatorial auction which would allow firms to enter separate bids for any or all of the following: both licences together, or each licence separately. However this option is not legally feasible.

E.24 Ofcom (and ComReg) has therefore tried to find the next best solution and has considered four options:

- two sequential sealed bid auctions
- two sequential simultaneous multi-round ascending (SMRA) auctions
- two simultaneous SMRA auctions
- two simultaneous sealed bid auctions

E.25 Ofcom has conducted an overall assessment of the impact of these options because the interests of businesses and consumers are generally aligned. The key criteria used to assess these options are:

- promoting the efficiency of the outcome of the auctions
- facilitating the realisation of synergies in the auction if that is the most efficient outcome
- encouraging participation in the auction if there are bidder asymmetries
- dealing with common value uncertainty
- simplicity and practicality

E.26 The fourth option, two simultaneous sealed bid auctions, was dismissed because it does not allow the realisation of synergies - bidders would have no way of judging their likelihood of winning both auctions and would essentially be unable to mitigate aggregation risks. The other three options are discussed in more detail in the paragraphs below.

### **Sequential sealed bids**

E.27 Holding sequential auctions facilitates the realisation of synergies to some degree. Bidders can set their strategy for the second auction contingent on the outcome of the

first auction. This eliminates the possibility of overpaying for whichever licence is auctioned second.

- E.28 A second advantage of this format is that sealed bid auctions should encourage ‘weak’ bidders to participate in the auction more than an SMRA format. Ofcom’s research indicates that bidder asymmetry could be an issue in this auction, although the evidence is far from conclusive. Finally, a sequential sealed bid process also benefits from being practical and low cost to implement, and carries minimal risk of auction failure because the bidding process is not complex.
- E.29 The main disadvantages of a sequential process is that the winner of the first auction still runs the risk of not winning the second licence and ending up having overpaid for the first licence. This could affect bidding strategies and lead to inefficient outcomes, in particular synergies may not be fully realised even when they turn to be the most efficient outcome. If there is a significant difference in the size of the two potential markets, holding the first auction in the jurisdiction which has the larger potential market may limit the potential impact of aggregation risks. This is because the synergies will have less of an impact on the viability of services in the jurisdiction with the larger potential market.
- E.30 The choice of pricing rule is also an important factor in the effectiveness of this option. If there is a first price rule, i.e. the winning firm pays what they bid, firms wanting licences in both jurisdictions will be cautious about how much of the potential “synergy premium” they bid in the first auction, in case they do not win the second<sup>13</sup>. However, if there are firms which only want to compete in the first auction, they will bid aggressively because they will be aware that the other bidders are likely to shade their bids. A first price rule therefore carries a risk that bidder wanting to exploit the synergies in operating in Ireland and Northern Ireland may not win the licences even though it valued the licences most highly.
- E.31 A second price rule, where the winning firms pay the value of the next highest bid, is better at allowing synergies to be realised than a first price rule. Firms which want to acquire both licences have an incentive to bid more aggressively with regard to the “synergy premium”, since if they win they will only pay the second highest bid. Aggregation risks are not fully eliminated, but should be lower than under a first price rule.

### **Sequential SMRA auctions**

- E.32 The sequential nature of this option makes its impact similar to the sequential sealed bid option, however it has some additional disadvantages. Firstly, as discussed above, bidder asymmetry is a potential concern. The more important bidder asymmetry is, the more likely that an SMRA format discourages participation in the auctions because ‘weak’ bidders will fear that ‘strong’ bidders will simply outbid them because they can bid the amount others bid.
- E.33 Secondly, SMRA auctions are more complex to run than sealed bid auctions and given the moderate amount of spectrum being auctioned together with the potential that the number of participants may also be moderate, a simpler auction format should be preferred on grounds of proportionality.

<sup>13</sup> In addition, firms will try to bid the minimum necessary to win each licence under this pricing rule, giving them another incentive to shade their bids.



E.34 If common value uncertainty was high, SMRA auctions would have an advantage over sealed bid auctions, but common value uncertainty appears to be low in importance in this award process - there is a wide range of potential uses which suggest that bidders' valuations are likely to be more independent than common.

### **Simultaneous SMRA auctions**

E.35 In theory it is possible for the simultaneous SMRA option to allow for the realisation of synergies. A standard SMRA approach would not be very effective in mitigating aggregation risks, however, and a number of additional features would need to be added to address this issue.

E.36 Firstly, bidders would need to be permitted to withdraw their bids to avoid becoming stranded and overpaying for one a licence. In this case the bid price would revert to that of the previous highest bidder. Secondly, the normal practice in an SMRA is to require that bidders remain active in each round in order to have the right to bid in the next round<sup>14</sup>. Not having this type of "activity rule" could enable bidders to gain information about others' preferences and devise a strategy that reduces the risk of being stranded with one licence.

E.37 In practice, however, it appears difficult to draw up such rules in ways which do not carry unwanted side-effects and run the risk of inefficiency. The auction process itself may lead to inefficiency for example:

- if there were several withdrawals for one licence, the price could drop down to a level where the winner was not the firm which valued the single licence most highly.
- if bidders do not have to bid each round to remain in the auction, the auction may grind to a halt because participants may not want to signal crucial information about their bidding strategies to their rivals.

E.38 Even if such rules could be drawn up, bidding strategies may become very complex and firms may make sub-optimal bidding decisions because of the difficulty of determining the best strategy. For example, the ability to withdraw in an SMRA is usually accompanied by a penalty<sup>15</sup>, therefore bidding strategies become multi-dimensional problems because they have to take into account to the interrelations between the potential penalties for withdrawing, how much of the synergy premium to bid on each licence and the potential valuations of other bidders.

### **Conclusion**

E.39 On the basis of the available evidence, Ofcom believes that a sequential sealed bid process with a second price rule is likely to secure the greatest benefit in terms of the efficient allocation of the spectrum and realisation of potential synergies in the context of efficient use of the spectrum. It also appears to be simpler and more practical to implement than the other options considered. The principal alternative in theory would be a simultaneous SMRA process. However, Ofcom's research has shown that it appears difficult to find a practical way of designing a simultaneous SMRA process which is capable of facilitating the realisation of synergies and which avoids strategic complexity for bidders.

<sup>14</sup> There may be some slack in the rule in the early stages, but in later stages the bidders are required to be fully active.

<sup>15</sup> This is normally the case in order to prevent manipulation or malicious disruption of the auction and is typically set as the difference between the bid that is withdrawn and the next highest bid (or the reserve price if there were no other bid).



## Annex F

# Legal annex

- F.1 In this annex ComReg and Ofcom set out the legal framework that is relevant to the award. This annex provides details of all the relevant European, Irish and UK legislation.
- F.2 Separately, but in this annex, Ofcom's duties and functions are given so that interested parties have the details of the legal framework and how this is applied in one place.

### European framework

- F.3 As Member States of the European Union, both Ireland and the UK have adopted the EU regulatory framework for Electronic Communications.
- F.4 Management of radio spectrum throughout the European Union is governed by the European Communications Directives, which aim to harmonise the regulation of electronic communications networks and services throughout the European Union.
- F.5 The European Communications Directives that need to be considered in this award process are:
- Directive 2002/20/EC of the European Parliament and of the Council on the authorisation of electronic communications networks and services, (the "Authorisation Directive");
  - Directive 2002/21/EC of The European Parliament And of The Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services ( the "Framework Directive");
  - Directive 2002/19/EC of the European Parliament and of the Council on access to, and interconnection of, electronic communications networks and services, ("the Access Directive");
  - Directive 2002/22/EC of the European Parliament and of the Council on universal service and users' rights relating to electronic communications networks and services, ("the Universal Service Directive"); and
  - Directive 2002/58/EC of the European Parliament and of the Council concerning the processing of personal data and the protection of privacy in the electronic communications sector, ("the Privacy and Electronic Communications Directive").
- F.6 Ireland and the UK discharge their obligations under the European Communications Directives in different ways and ComReg and Ofcom carry out their functions under a variety of legislation, which is relevant to their respective jurisdictions.
- F.7 The following section deals with how both ComReg and Ofcom carry out their respective duties and functions in relation to awarding radio spectrum in accordance with relevant European and national legislation.

### ComReg's Objectives and Powers

- F.8 The following sections deal with how ComReg carries out its objectives and powers in relation to awarding radio spectrum in accordance with the relevant European and national legislation. This section does not provide a comprehensive statement of all

legal provisions which may be relevant to ComReg's functions and powers in relation to the award of wireless telegraphy licences for the use of the Spectrum Band.

### **ComReg's objectives in exercising its functions**

- F.9 Under s.12(1) of the Communications Regulation Act, 2002 ('the 2002 Act') the objectives of ComReg in exercising its functions include:
- F.10 - In relation to the provision of electronic communications networks, electronic communications services and associated facilities
- F.11 (i) to promote competition, including ensuring that users derive maximum benefit in terms of choice, price and quality, encouraging efficient investment in infrastructure and promoting innovation, and encouraging efficient use and ensuring the effective management of radio frequencies.
- F.12 (ii) to contribute to the development of the internal market, including removing remaining obstacles to the provision of electronic communications networks, electronic communications services and associated facilities at Community level, encouraging the establishment and development of trans-European networks and the interoperability of transnational services and end-to-end connectivity and co-operating with electronic communications national regulatory authorities in other Member States of the Community and with the Commission of the Community in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of Community law in this field.
- F.13 (iii) to promote the interests of users within the Community
- F.14 - to ensure the efficient management and use of the radio frequency spectrum
- F.15 Pursuant to s.13 of the 2002 Act, The Minister for Communications Marine and Natural Resources has issued two sets of policy directions to ComReg to be followed in the exercise of its functions. ComReg must comply with any such direction. The following are amongst those of relevance to spectrum management:
- o Direction 1 of February 2003 - In carrying out its functions, ComReg 'shall have regard to the Programme for Government 2002, including the provision of the Programme set out in the section "Building Peace and Justice" stating: "We will improve North-South infrastructural links and facilitate cross-border planning", and the objectives set out in the section "Developing the Regions and the Islands" as well as the provisions relating to electronic communications set out in the section "Research, Development and Innovation',
  - o Direction 11 of February 2003 - ComReg shall 'ensure that, in its management of the radio frequency spectrum, it takes account of the interests of all users of the radio frequency spectrum.'
  - o Direction 3(b) of March 2004 – 'ComReg shall, subject to relevant requirements under European and National law, identify barriers, work closely with operators and Ofcom, and use regulatory and enforcement tools to encourage and support initiatives that would: reduce the costs for people on the island making and receiving calls on their mobile phones to numbers within Northern Ireland; reduce or eliminate roaming and other charges on the island between Ireland and Northern Ireland; encourage national call charging

on an all-island basis. The goal is to minimise cross border roaming and other charges on the island of Ireland for mobile phone users, particularly those who live close to the border.’

### Granting wireless telegraphy licences

- F.16 ComReg’s power to grant wireless telegraphy licences is set out in s.5 the Wireless Telegraphy Acts 1926 to 1988, as amended (‘The Act of 1926’). s.3(1) of the 1926 Act provides that it is an offence for any person to keep or have in his possession any apparatus for wireless telegraphy, except where as such keeping or possession is authorised by a licence granted by ComReg.
- F.17 S.5 of the 1926 Act provides that every licence granted under the Act of 1926 shall be as prescribed by regulations made by ComReg. S.6(1) of the Act of 1926 provides that ComReg can make regulations setting out *inter alia* the form of such licences, the period during which such licences continue in force and the terms and conditions to be observed by the holders of such licences. S.37 of the 2002 Act provides that such regulations will not be made other than with the consent of the Minister.
- F.18 S.6 of the Act of 1926 sets out what ComReg can prescribe in relation to licences and the procedures for making the regulations. Regulation 10 of the Authorisation Regulations<sup>16</sup> provides that, subject to any regulations under s.6 of the Act of 1926, ComReg may only attach such conditions as are listed in Part B of the Schedule to the Authorisation Regulations. Regulation 10(2) provides that *inter alia* conditions attached to licences be objectively justified, non-discriminatory, proportionate and transparent.

### Charging fees for wireless telegraphy licenses

- F.19 ComReg has power under s.6(1)(f) of the Act of 1926 to prescribe in the regulations in regard to licences the fees to be paid on the grant or renewal of such licenses and the time and manner at and in which such fees are to be paid. Regulation 20(1) of the Authorisation Regulations provides that ComReg must ensure that any such fees are objectively justified, transparent, non- discriminatory and proportionate in relation to their intended purpose and shall take into account its objectives as set out in s.12 of the Act of 2002.

### Ofcom’s Duties and Functions

- F.20 This section provides a brief overview of the main UK and European legislative provisions relevant to the award of the Wireless Telegraphy Act licence for the Spectrum Band. This section does not provide a comprehensive statement of all legal provisions which may be relevant to Ofcom’s functions and to the award of wireless telegraphy licences for the use of the Spectrum Band.
- F.21 Under section 3(1) of the Communications Act 2003 it is the principal duty of Ofcom in carrying out its functions:
- (a) to further the interests of citizens in relation to communications matters; and
  - (b) to further the interests of consumers in relevant markets, where appropriate by promoting competition.

<sup>16</sup> S. I. No. 306 of 2003 the European Communities (Electronic Communications Networks and Services (Authorisation) Regulations 2003 which transposes the Authorisation Directive

In doing so, Ofcom is required to secure (under section 3(2)):

- (a) the optimal use for wireless telegraphy of the electro-magnetic spectrum;
- (b) the availability throughout the UK of a wide range of services;
- (c) the availability throughout the UK of a wide range of TV and radio services which (taken as a whole) are both of high quality and calculated to appeal to a variety of tastes and interests;
- (d) the maintenance of a sufficient plurality of providers of different television and radio services;
- (e) the application in the case of all television and radio services of standards that provide adequate protection to members of the public from the inclusion of offensive and harmful material, unfair treatment in programmes and unwarranted infringement of privacy;

and to have regard to certain matters which include:

- principles of better regulation (section 3(3));
- the desirability of promoting competition (section 3(4));
- the desirability of encouraging investment and innovation (section 3(4)(d));
- the desirability of encouraging availability and use of broadband services throughout the UK (section 3(4)(e));
- 3(4)(f) the different interests of persons in different parts of the UK (section 3(4)).

F.22 Section 4 of the Communications Act 2003 requires Ofcom when carrying out its spectrum functions to act in accordance with the “six community requirements” set out in that section when managing the wireless spectrum in the UK. Of relevance are the following:

- The requirement to promote competition (section 4(3));
- The requirement to secure that Ofcom’s activities contribute to the development of the European internal market (section 4(4));
- The requirement to promote the interests of all persons who are citizens of the European Union (section 4(5));
- The requirement to act in a technology neutral way (section 4(6));
- The requirement to encourage to such extent as appropriate the provision of network access and service interoperability (section 4(7)); and
- The requirement to encourage such compliance with international standards as is necessary for (a) facilitating service interoperability; and (b) securing freedom of choice for the customers of communications providers (sections 4(9) and (10)).

## **Ofcom's duties when carrying out its spectrum management functions**

F.23 In carrying out its spectrum functions it is the duty of Ofcom (under section 154 of the Communications Act 2003) to have regard in particular to:

- the extent to which the spectrum is available for use or further use, for wireless telegraphy;
- the demand for use of that spectrum for wireless telegraphy; and
- the demand that is likely to arise in future for the use of that spectrum for wireless telegraphy.

F.24 It is also the duty of Ofcom to have regard, in particular, to the desirability of promoting:

- the efficient management and use of the spectrum for wireless telegraphy;
- the economic and other benefits that may arise from the use of wireless telegraphy;
- the development of innovative services; and
- competition in the provision of electronic communications services.

F.25 Where it appears to Ofcom that any of its duties in section 154 conflict with one or more of its general duties under sections 3 to 6 of the 2003 Act, priority must be given to its duties under those sections.

## **Granting wireless telegraphy licences**

F.26 Ofcom's legal power to grant wireless telegraphy licences is set out in the Wireless Telegraphy Act of 1949. Section 1(1) of that Act makes it an offence for any person to establish or use any station for wireless telegraphy or to install or use any apparatus for wireless telegraphy except under and in accordance with a licence granted by Ofcom under that section (a wireless telegraphy licence).

F.27 Section 1(2) of that Act gives Ofcom the power to grant wireless telegraphy licences subject to such terms as Ofcom thinks fit. However, Ofcom's broad discretion in relation to the terms that can be imposed in a wireless telegraphy licence is subject to the rule that Ofcom must impose only those terms that it is satisfied are objectively justifiable in relation to the networks and services to which they relate, not unduly discriminatory, and proportionate and transparent as to what they are intended to achieve (section 1D(9)).

### **Providing for an auction for wireless telegraphy licences**

- F.28 Under Article 5(2) of the Directive on the authorisation of electronic communications networks and services 2002/20/EC (the “Authorisation Directive”), when granting rights of use of radio frequencies (wireless telegraphy licences in the UK context), Member States must do so through open, transparent and non-discriminatory procedures.
- F.29 Under Article 7(2) of the Authorisation Directive where the number of rights of use of radio frequencies needs to be limited, Member States’ selection criteria must be objective, transparent, non-discriminatory and proportionate. (Section 164 of the Communications Act 2003 requires Ofcom to make an order setting out the criteria.)
- F.30 Within that context, Ofcom has power under section 3 of the Wireless Telegraphy Act 1998 (having regard to the desirability of promoting the optimal use of the electromagnetic spectrum) to make regulations providing that applications for the grant of wireless telegraphy licences must be made in accordance with a procedure which involves the applicants making bids for licences (for example an auction).
- F.31 Ofcom has broad powers in section 3(3) to make provision in regulations for the form of the licences and the auction bidding procedure.

### **Charging fees for wireless telegraphy licences**

- F.32 Ofcom also has power, under section 1 of the Wireless Telegraphy Act 1998, to prescribe in regulations fees that are payable in respect of wireless telegraphy licences. Under section 2 Ofcom may prescribe sums which are greater than necessary for the purpose of recovering costs, if it thinks fit in the light (in particular) of the matters to which they are to have regard under section 154 of the Communications Act 2003.
- F.33 The fees for most wireless telegraphy licences are set out in such regulations (including those fees which are set by Ofcom in order to encourage the use of the spectrum). The current regulations are the Wireless Telegraphy (Licence Charges) Regulations 2005 (SI 2005/1378).
- F.34 Under Article 13 of the Authorisation Directive, any fees imposed for rights of use of radio frequencies shall reflect the need to ensure the optimal use of the resources. Such fees must be objectively justifiable, transparent, non-discriminatory and proportionate in relation to their intended purpose (and take into account the objectives set out in Article 8 (Policy objectives and regulatory principles) of Directive 2002/21/EC (the “Framework Directive”).

## Annex G

# Ofcom's draft licence

G.1 Please note that the following template licence represents Ofcom's current thinking and may well change as Ofcom's thinking develops and after consideration of responses to this consultation.

Wireless Telegraphy Acts 1949 and 1998  
Office of Communications (Ofcom)

LICENCE FOR THE USE OF THE SPECTRUM BAND 1785 – 1805 MHz (Northern Ireland)

Licence no. [Insert Licence Number]

Date of issue: [Insert Date]

Fee payment date: [Insert Date] (annually)

1. The Office of Communications (Ofcom) grants this licence to

[Insert Licensee's Name and Company Registration Number (if a company)]  
("the Licensee")  
[Insert Registered Company Address]  
XXXXXXXXXXXX  
XXXXXXXXXXXX  
XXXXXXXXXXXX  
XXXXXX

to establish, install and use radio transmitting and receiving stations and/or radio apparatus as described in the schedule(s) (herein after together called "the Radio Equipment") subject to the terms, set out below.

### Licence Term

2. This Licence shall continue in force unless surrendered by the Licensee or revoked by Ofcom in accordance with paragraph 3 below.

### Licence Revocation

3. Pursuant to section 4 of the Wireless Telegraphy Act 1998 (the "1998 Act") Ofcom may not revoke this Licence under section 1(4) of the Wireless Telegraphy Act 1949 except:

- a. at the request of, or with the consent of, the Licensee;
- b. in accordance with paragraph 8 to 11 ;
- c. if there has been a material breach of any of the conditions of the Licence;
- d. if, in connection with the transfer or proposed transfer of rights and obligations arising by virtue of the Licence, there has been a breach of any provision of

## Award of available spectrum: 1785 - 1805 MHz

regulations made by Ofcom under the powers conferred by section 168(1) and (3) of the Communications Act 2003<sup>17</sup> ;

- e. if the Licensee has been found to the reasonable satisfaction of Ofcom to have been involved in any act, or omission of any act, constituting a material breach of the Wireless Telegraphy ([Auction]) Regulations [2006] (the “Regulations”);
  - f. in accordance with section 4(5) of the 1998 Act;
  - g. if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purposes of complying with a direction by the Secretary of State given to Ofcom under section 5 or section 156 of the Communications Act 2003; or
  - h. for reasons related to the management of the radio spectrum, provided that in such case:
    - the power to revoke may only be exercised after at least five (5) year’s notice is given in writing to the Licensee; and
    - such notice must expire after fifteen (15) years from the date of issue of this Licence.
4. Where Ofcom exercise their power to revoke or vary the Licence in accordance with section 1(4) of the Wireless Telegraphy Act 1949, the Licensee shall be notified in writing.

5. For the avoidance of doubt, and without prejudice to paragraphs 3 and 4 above, Ofcom may only revoke this Licence in accordance with section 1E of the Wireless Telegraphy Act 1949.

### Changes

6. The Licence may not be transferred except in accordance with regulations made by Ofcom under powers conferred by section 168(1) and (3) of the Communications Act 2003.<sup>18</sup>

7. The Licensee must give immediate notice to Ofcom in writing of any change to the Licensee’s name and address from that recorded on the Licence.

### Fees

8. The Licensee shall pay to Ofcom the fee(s), in cash and without set-off or counter-claim, described in Schedule 2 of this Licence, on the date(s) also described therein, failing which Ofcom may revoke this Licence.

9. On or after the expiry of fifteen (15) years from the date of issue of this Licence the Licensee shall pay to Ofcom such sum(s) as may be provided for in regulations made by Ofcom under section 1 and 2(2) of the Wireless Telegraphy Act 1998, failing which Ofcom may revoke this Licence.

10. The Licensee shall also pay interest to Ofcom on any amount which is due under the terms of this Licence or provided for in any regulations made by Ofcom under section 1 and 2(2) of the Wireless Telegraphy Act 1998 from the date such amount falls due until the date

<sup>17</sup> These are regulations on spectrum trading.

<sup>18</sup> However rights and obligations arising by virtue of certain wireless telegraphy licences may be transferred in accordance with regulations made by Ofcom under powers conferred by section 168(1) and (3) of the Communications Act 2003. See Ofcom’s website for the latest position on spectrum trading and the types of trade which are permitted.



of payment, calculated with reference to the Bank of England base rate from time to time. In accordance with section 4A of the Wireless Telegraphy Act 1998 any such amount and any such interest is recoverable by Ofcom.

11. If the Licence is surrendered or revoked, no refund, whether in whole or in part of any amount which is due under the terms of this Licence or provided for in any regulations made by Ofcom under section 1 and 2(2) of the Wireless Telegraphy Act 1998 will be made, except at the absolute discretion of Ofcom in accordance with [regulation X] of the Regulations.

### **Radio Equipment Use**

12. The Licensee must ensure that the Radio Equipment is constructed, established, installed and used only in accordance with the provisions specified in Schedule 1 of this licence. Any proposal to amend any detail specified in Schedule 1 of this licence must be agreed with Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.

13. The Licensee must ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.

### **Access and Inspection**

14. The Licensee shall permit a person authorised by Ofcom:

- a. to have access to the Radio Equipment; and
- b. to inspect this Licence and to inspect examine and test the Radio Equipment,

at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time to ensure the Radio Equipment is being used in accordance with the terms of this Licence.

### **Modification, Restriction and Closedown**

15. A person authorised by Ofcom may require the Radio Equipment, or any part thereof, to be modified or restricted in use, or temporarily or permanently closed down immediately if in the opinion of the person authorised by Ofcom:

- a. a material breach of this Licence has occurred; and/or
- b. the use of the Radio Equipment is causing or contributing to undue interference to the use of other authorised radio equipment.

16. Ofcom may require the Radio Equipment to be modified or restricted in use, or temporarily closed down either immediately or on the expiry of such period as may be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice is served on the Licensee or a general notice applicable to holders of a named class of Licence is published.

### **Geographical Boundaries**

**Award of available spectrum: 1785 - 1805 MHz**

17. This Licence authorises the Licensee to establish, install and use the Radio Equipment only in the Northern Ireland.

**Interpretation**

18. In this Licence:
- a. the establishment, installation and use of the Radio Equipment shall be interpreted as establishment and use of stations and installation and use of apparatus for wireless telegraphy as specified in section 1 of the Wireless Telegraphy Act 1949;
  - b. the expression "undue interference" shall have the meaning given by Section 19 of the Wireless Telegraphy Act 1949;
19. The schedule(s) to this Licence form part of this Licence together with any subsequent schedule(s) which Ofcom may issue as a variation to this Licence at a later date;
20. The Interpretation Act 1978 shall apply to the Licence as it applies to an Act of Parliament.

Issued by Ofcom

Signed by

For the Office of Communications

## **SCHEDULE 1 TO LICENCE NUMBER: [Insert Licence Number]**

Licence Category: Licence for the Use of the Spectrum Band 1785 – 1805 MHz  
(Northern Ireland)

This schedule forms part of licence no [Insert Licence Number], issued to [Insert Licensee's name], on [Insert Date].

### 1. Description of Radio Equipment Licensed

In this Licence, the Radio Equipment means any station or apparatus that transmits in accordance with the requirements of paragraphs 7, 8, 9 and 10 of this schedule.

### 2. Interface Requirements for the Radio Equipment

That Radio Equipment shall comply with any relevant Interface Requirements:

Interface Requirements are published by Ofcom in accordance with Article 4.1 of Directive 1995/5/EC of the European Parliament and of the Council on radio equipment and telecommunications terminal equipment (RTTE) and the mutual recognition of their conformity."

### 3. Special Conditions relating to the Operation of the Radio Equipment

(a) During the period that this Licence remains in force and for 6 months thereafter, the Licensee shall compile and maintain accurate written records of:

(i) The following details relating to the Radio Equipment:

- a) postal address;
- b) National Grid Reference, (to 100 Metres resolution);
- c) antenna height (AGL) and type;
- d) radio frequencies in operation;

(ii) a statement of the number of subscribing customers;

the Licensee must produce the above records when a person authorised by Ofcom requires him to do so.

(iii) without prejudice to this sub-paragraph (a), the Licensee shall furnish Ofcom in such a manner and at such times as reasonably requested, information in the form of documents, accounts, estimates, returns and any other information which may be reasonably required for the purposes of verifying compliance with this Licence and for statistical purposes;

(b) The Licensee shall inform Ofcom of the address of the premises at which this Licence and the information detailed at sub-paragraph (a) above shall be kept.

(c) The Licensee must submit to Ofcom copies of the records detailed in sub-paragraph (a) above at such intervals as Ofcom shall notify to the Licensee.

4. Site Clearance Requirements

A valid site clearance certificate, issued by Ofcom is required for all Radio Equipment except base transceiver stations incorporating transmitters radiating not more than 17dBW ERP and/or aerial systems, the highest point of which is less than 30 metres above ground level and which does not increase the height of an existing (site cleared) structure by 5 metres or more.

5. Cross-border Coordination

The Radio Equipment shall be operated in compliance with such cross-border coordination and sharing procedures as may be considered necessary and notified to the Licensee by Ofcom. The threshold for coordination shall be [to be specified] dB $\mu$ V/m (dBm/100 kHz)

6. Frequencies of Operation

The Radio Equipment may only operate in following frequency band:

1785 – 1805 MHz

7. Maximum Permissible EIRP

The maximum EIRP per carrier is 56 dBm/MHz (400 W).

8. Antenna Height

The highest point of outdoor antenna systems shall be no more than 10 meters above ground level.

9. Permissible Out-of-Block Emissions

unwanted emissions outside the Spectrum Band (Out-of-Block Emissions) from the Radio Equipment must not exceed -126 dBm/100 kHz .

11. Interpretation of terms in this Schedule

In this Schedule:

"EIRP" means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain);

"dBW" means the power level in decibels (logarithmic scale) referenced against 1 Watt. (i.e. a value of 0 dBW is 1 W);

"dBm" means the power level in decibels (logarithmic scale) referenced against 1 milliWatt (i.e. a value of 0 dBm is 1 mW);

"Out-of-block emissions" are defined as radio frequency emissions generated by the system operated by the licensee but radiated into the spectrum adjacent to the licensee's permitted frequencies of operation;

“Threshold level for coordination” means that field strength (measured in micro Volts per metre) that, if breached, shall trigger the requirement for coordination.

## Annex H

# Glossary of technical terms

### **Band**

A defined range of frequencies that may be allocated for a particular radio service, or shared between radio services.

### **CEPT**

Conference of European Postal and Telecommunications administrations, comprising over 40 European administrations.

### **dB**

Decibel.

### **dBm**

Decibels above one milliwatt: a logarithmic representation of radio frequency power with respect to one milliwatt.

### **dBW**

Decibels above one Watt: a logarithmic representation of radio frequency power with respect to one Watt.

### **DCS 1800**

Digital Cellular System; term used to describe GSM implementation in frequencies around 1800 MHz. GSM was initially implemented in the 900 MHz band. DCS 1800 is now more commonly known as GSM 1800. See GSM

### **DECT**

Digital Enhanced Cordless Telecommunications: an access technology used in private cordless telephone equipment.

### **ECC**

Electronic Communications Committee: a committee that reports to CEPT.

### **EIRP**

Equivalent Isotropically Radiated Power: a theoretical measure of the power radiated by a transmitter/antenna - defined as the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna.

### **ERP**

Effective Radiated Power: a theoretical measure of the power radiated by a transmitter/antenna - defined as the product of the power supplied to the antenna and its gain relative to a halfwave dipole in a given direction.

### **ETSI**

European Telecommunications Standards Institute; a European based industry group that addresses equipment standards for telecommunications equipment.

### **GHz**

Gigahertz: a unit of frequency equal to 1000 million ( $1 \times 10^9$ ) Hz or cycles per second.

### **GSM**

Global System for Mobile communications; a 2G mobile phone technology. This is the technology behind the vast majority of 2G mobile phones used across Europe and is used by approximately 80% of 2G operators worldwide. Also sometimes referred to under its original meaning of "Groupe Spécial Mobile".

## **HC-SDMA 9**

High Capacity Spatial Division Multiplex. Radio interface standard for wireless wideband access. The HC-SDMA interface provides wide-area broadband wireless IP data-connectivity for fixed, portable and mobile computing devices and appliances.

## **kHz**

Kilohertz: a unit of frequency, equal to 1000 ( $1 \times 10^3$ ) Hz or cycles per second.

## **ITU**

International Telecommunication Union: an international organisation within the United Nations System where governments and the private sector coordinate, discuss and agree the logistics of global telecom networks and services.

## **MHz**

Megahertz: a unit of frequency equal to 1,000,000 ( $1 \times 10^6$ ) Hz or cycles per second.

## **Out-of-block emissions**

Emissions cause by use of the spectrum covered by a particular licence that fall immediately outside the spectrum block covered by that licence.

## **TETRA**

Terrestrial enhanced Trunked Radio Access: An ETSI standard for digital mobile radio utilised by fleets of vehicles such as emergency services, courier companies etc.

## **UTRA TDD**

Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access Time Division Duplex. Term used for the UMTS radio interface.

## **WiMax**

Worldwide interoperability for Microwave Access. A certification mark for products that pass conformity and interoperability tests for the [IEEE 802.16](#) standards.