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

Publication date: 15 December 2005

Closing Date for Responses: 2 March 2006

Contents

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

	Ireland[1]	Northern Ireland
Spectrum Packaging and Licensing		
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.

[1] Ireland is used in this document to refer to the 26 Counties of the Republic of Ireland.

	Ireland[1]	Northern Ireland
Licence fees	The auctions will determine the fees payable for each licence in each jurisdiction. 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.	
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.
Award mechanisms and Rules (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[1]	**Northern Ireland**
Prohibitions on bidder association and collusion	There will be specific rules to prohibit collusion.	
Reserve prices	Two reserve prices will be set, one for the licence awarded by ComReg and one for the licence to be awarded by Ofcom. The reserve price for the Ireland licence will be €150,000 The reserve price for the Northern Ireland licence will be £50,000	
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

- 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[2] to fixed and mobile radiocommunication services on a primary basis[3]. Provision is also made for public correspondence transmissions from aircraft[4]. 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[5]. However, it is possible to offer services other than those to which the Spectrum Band is allocated[6]. 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[7] 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

[2] Table of Allocations, Article 5 of the ITU Radio Regulations.
[3] 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.
[4] 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)
[5] Constitution and Convention of the International Telecommunication Union, Execution of the Instruments of the Union, Article 6 (37),
[6] ITU Radio Regulations, Assignment and use of frequencies, General rules, Article 4.4
[7] 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

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.

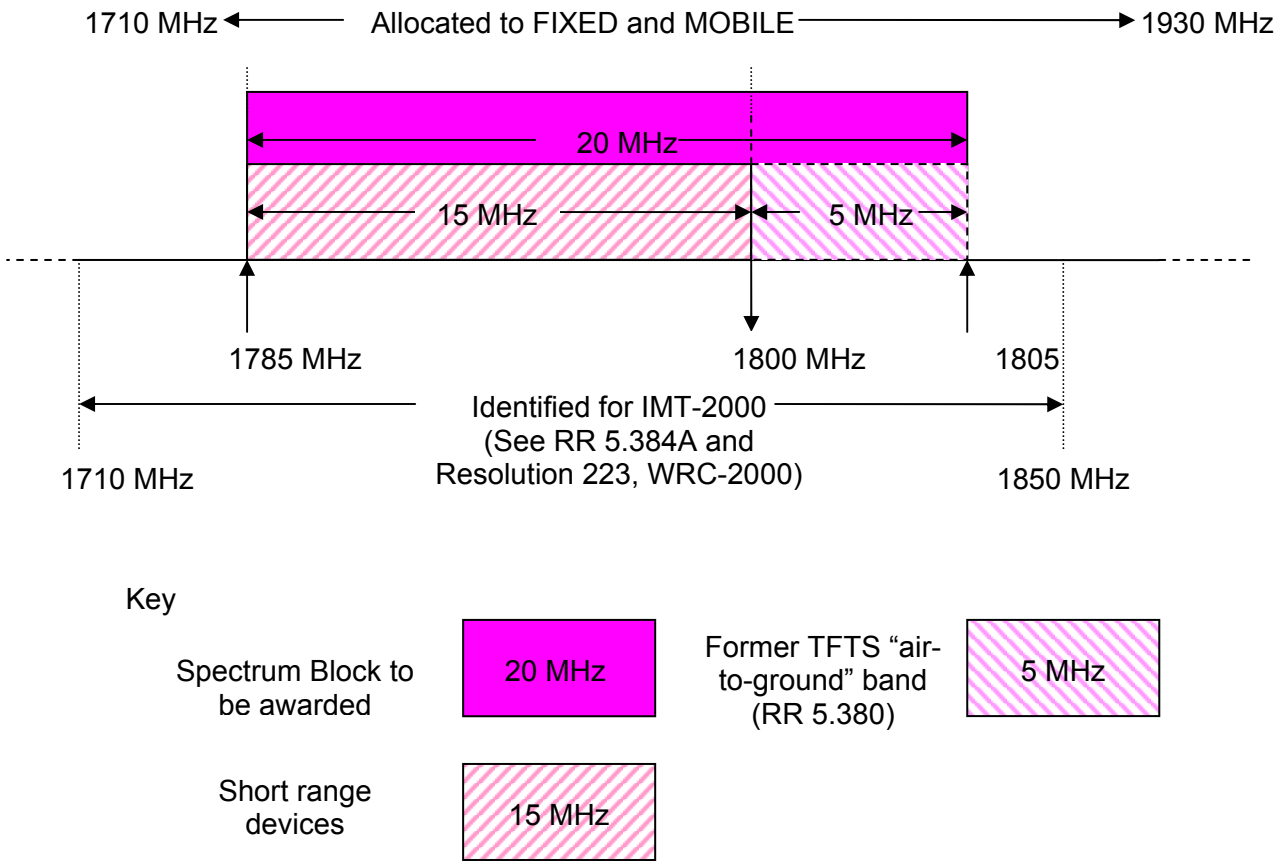
4.6 ComReg and Ofcom do not consider that the current discussions in relation to possible further harmonisation measures concerning 1800-1805 MHz should prevent the award proposed in this document from proceeding. ComReg and Ofcom would expect any future harmonisation measure to take into account existing 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[8]. 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/.

[8] 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[9]. 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

[9] Recommendation - ERC/REC 70-03.

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).

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.

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

	co-ordinated award vs separate awards	All-UK vs separate awards
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 paring 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.

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

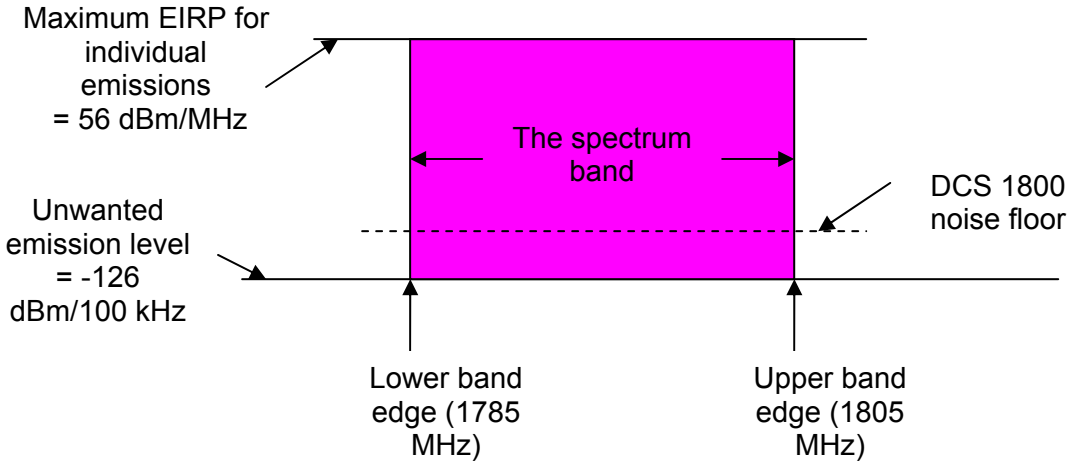
6.37 No guard bands will be used outside the Spectrum Band and licensees must meet the block edge mask. The limit of -126 dBm/100 kHz will apply to all unwanted emissions including spurious and out-of-band emissions. The limit on unwanted emissions into the adjacent band services is intended to be completely 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)[10]. That document looks, in particular, at how a Band

[10] 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. The Trading Regulations are published by OPSI and available at 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[11]. 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

[11] 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

- 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.