

Spectrum Framework Review: Implementation Plan

This document consults on the release of spectrum in 2005 – 08, and on extending spectrum liberalisation and trading to mobile services

Consultation document

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Section 1

Executive summary

Spectrum is a key resource

- 1.1 Radio spectrum is a vital input to electronic communication services and networks and a major asset to the UK. One of Ofcom's primary statutory duties is to ensure the optimal use of the radio spectrum in the interests of citizens and consumers. It is essential that the regulatory regime for spectrum is able to respond to changes in the demand for and use of spectrum in the UK.

The way we manage spectrum is changing

- 1.2 Ofcom published its Spectrum Framework Review (SFR) in November 2004. This extends and consolidates earlier publications relating to spectrum management, especially those making it possible for licensees to buy and sell spectrum in the market ("spectrum trading") and reducing or removing unnecessary restrictions and constraints on spectrum use ("spectrum liberalisation").
- 1.3 Ofcom's vision for spectrum management, as set out in the SFR, is for market forces to play an increasingly important role in determining how spectrum is used. Ofcom believes that this will encourage efficiency in spectrum use, by increasing the likelihood that spectrum will be held by those who can make best use of it, and by creating more freedom for spectrum to be used for more valuable applications.

Two important areas of implementation

- 1.4 This document addresses how the vision for spectrum management set out in the SFR can be implemented in two key areas. It meets Ofcom's commitment to provide a "roadmap" for these changes in spectrum management. The two areas are:
 - The release of newly available spectrum into the market over the next 2-3 years.
 - The transition to spectrum trading and liberalisation in relation to mobile services

Newly available spectrum

- 1.5 This document identifies the spectrum that Ofcom currently expects to be able to make available to the market over the next 2-3 years. Its focus is on new licence awards that are likely to follow a competitive process, usually an auction. In publishing these proposals, Ofcom's aim is to give the market more clarity than before about likely future opportunities to obtain new spectrum licences, and to seek views on a wide range of issues, including the relative priority of releasing different bands and the design of new licences.
- 1.6 In total, Ofcom expects that spectrum in about twelve different bands should become available for award over the period 2005-2008. Some of these bands are relatively small, or likely to be of limited application. But others – including the 190MHz of spectrum in the 2500-2690 MHz range – represent substantial capacity in a prime part of the radio spectrum.

- 1.7 Each of the bands is discussed in detail in this document. Where demand for the spectrum is likely to exceed supply, Ofcom generally expects to make awards by auction. Consistent with its general policy towards spectrum management, Ofcom also expects to leave as much freedom as possible to the market to determine the optimum use of the spectrum. In each case where Ofcom does decide to proceed with an auction, we will carry out a further detailed consultation on the details of auction design and spectrum packaging before the awards are made.
- 1.8 The table below summarises the proposals in this document for new awards in bands below 3GHz.

Bands below 3GHz	2005-2006	2006- 2007	2007-2008
1781-1785 MHz/1876-1880 MHz (GSM/DECT guard bands)	•		
2290-2302 MHz	•		
2010-2025 MHz	•		
410-415 MHz/420-425 MHz, 872-876 MHz/917-921 MHz (Ex-Inquam bands)	•		
2500-2690 MHz		•	
1452 -1492 MHz (L Band)		•	
1790-1798 MHz			•

- 1.9 It is important to stress that these timings are indicative only. Ofcom's plans may change following this consultation. Ofcom also faces important external constraints in a number of bands, either because satisfactory arrangements may need to be agreed with public sector users (including the Civil Aviation Authority (CAA) and Ministry of Defence (MoD), or because decisions are needed at European level. As a separate matter, Ofcom has already indicated (see *Radio – Preparing for the Future*, published 15 December 2004) that it expects to consult on the timing of an award in Band III in Spring 2005.
- 1.10 Ofcom also expects to make a number of awards in bands over 3 GHz during this period. These include the possibility of further awards at 10GHz, 28 GHz and 32 GHz. Similar caveats apply to the timing of these awards.
- 1.11 Meeting this auction programme will be challenging for Ofcom and for stakeholders. However Ofcom believes that it is important that spectrum is released to the market as soon as possible to allow operators to determine efficient uses of the spectrum and so bring benefits to consumers and citizens.
- 1.12 This document does not contain any major proposals in relation to the spectrum that might be released by the switchover of television to digital broadcasting (within 470 -854 MHz). Ofcom does not expect to make policy decisions on this until after the Regional Radio Conference in 2006.
- 1.13 The focus of this document is on spectrum that Ofcom already expects to become available for assignment in 2005-08. In the longer term, other spectrum may also become available particularly as a result of the review of spectrum holdings now being undertaken at the Government's request by Professor Martin Cave. Ofcom is actively supporting this review.

The transition to trading and liberalisation for mobile services

- 1.14 The extension of trading and liberalisation to these bands was discussed briefly in Ofcom's consultation on spectrum trading in November 2003. This document sets out more detailed proposals on implementing trading and liberalisation for mobile services. In particular, it considers two sets of issues:
- The removal of restrictions from licences that presently prevent the use of spectrum for the provision of mobile services, including 3G services and mobile services other than 3G .
 - The potential extension of spectrum trading and liberalisation to the bands currently licensed for 2G and 3G mobile services.
- 1.15 On the first of these issues, this document proposes that Ofcom should in general be willing to remove licence restrictions as soon as practicable that prevent the use of spectrum for mobile services other than 3G services, where it is possible to do so under law and subject to interference constraints and international obligations. Other considerations may also be relevant in some cases, including the terms on which certain licences were recently auctioned.
- 1.16 This document also considers the removal of restrictions from licences that prevent the use of spectrum for 3G mobile services. It identifies a range of considerations that need to be taken into account, and a range of options for balancing these. It suggests that for licences other than the existing 2G licences, the option of allowing the removal of such restrictions after a transitional period has elapsed might offer an appropriate balance between the relevant considerations, and might maximise the interests of citizens and consumers. It suggests that a suitable transitional period might last to 2007. Restrictions on the provision of 3G services could only be removed where it is possible to do so under law and subject to interference constraints and international obligations.
- 1.17 On the second issue, this document identifies several issues that make the extension of trading and liberalisation to the existing 2G bands more complex than is the case with most other bands. These include the existence of European harmonisation measures affecting the use of the bands, and the circumstances of the 3G auction held in 2000. Through this auction the Government created a market structure for the provision of 3G services with five licences, of which the largest was reserved to a new entrant. It is possible that variations in the terms of the 2G licences held by existing 2G licensees (for example to allow 3G services) might have a disadvantageous effect on the competitive position of this new entrant, compared to the other operators.
- 1.18 Given these two important complications, Ofcom considers that further work is needed before firm proposals can be made for liberalising the bands currently used for 2G services. This document therefore sets out an initial analysis of the potential problems and options, for discussion and comment. In parallel Ofcom is also commissioning an independent economic study to evaluate further the scale of the issues and possible solutions. Further consultation may take place once Ofcom has responses to this document and the results of the economic study.
- 1.19 This document also discusses the rollout obligations contained in the 3G licences. It sets out proposed draft guidance on Ofcom's approach to enforcing the obligations for consultation. In brief, this indicates that if the licence obligations are not met by the due date at the end of 2007, then Ofcom would consider the

appropriate enforcement action to take in the light of the relevant circumstances at the time. Ofcom's current expectation is that – other than in the case of serious non-compliance – revocation of an operator's licence is unlikely to be an appropriate or proportionate response.

Next steps

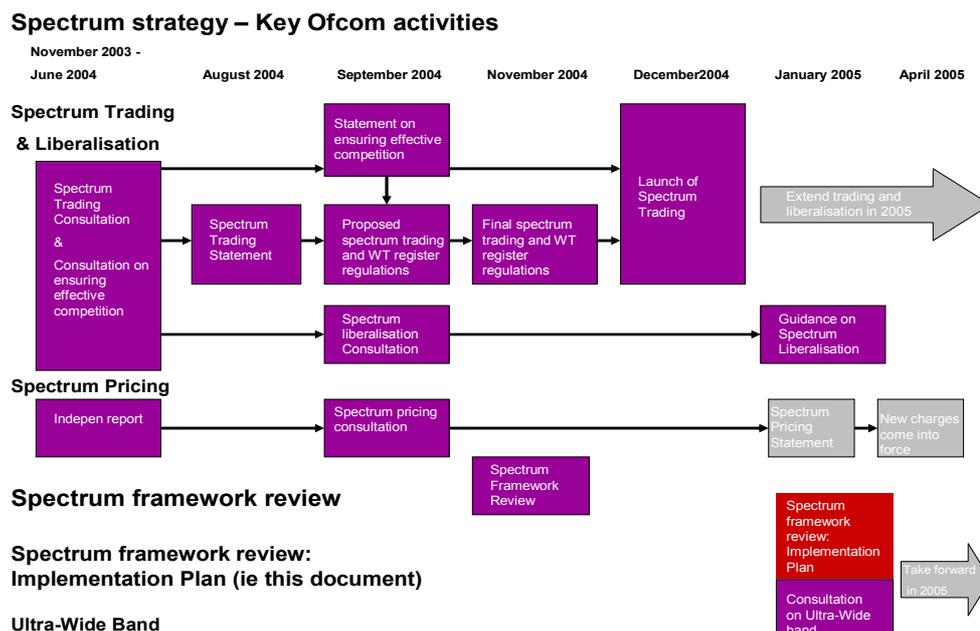
- 1.20 Ofcom invites comments on the issues raised in this document. A number of specific questions are set out (see Annex C for a summary) but other comments are also welcome. The closing date for responses is 24 March 2005.
- 1.21 Following consideration of the responses, Ofcom is likely to publish a number of further documents in order to take forward the wide range of issues and proposals discussed in this document. Publication of these subsequent documents is likely to begin in late Spring 2005.

Section 2

Introduction

- 2.1 This document consults on Ofcom's plans to apply its new approach to spectrum management to a wide range of individual bands. The new approach has been set out in a number of documents published by Ofcom over the past year, including the Spectrum Framework Review ("SFR") published in November 2004, the Spectrum Trading consultation document published in November 2003 ("Trading Consultation Document"), the Spectrum Trading Statement published in August 2004 ("Trading Statement") and in the Spectrum Liberalisation consultation document published in September 2004 ("Liberalisation Consultation Document"). The new approach is summarised in Section 3.
- 2.2 In the Trading Statement and Liberalisation Consultation Document, Ofcom committed to publishing a "spectrum roadmap" which would provide stakeholders with clarity about Ofcom's approach to several connected short-and-medium term spectrum management issues relevant to frequency bands suitable for mobile and broadband services. This document fulfils that commitment.
- 2.3 The document aims to consult on Ofcom's proposed approach to the following:
- how and when Ofcom intends to release un-used or under used spectrum into the market
 - how the policies of spectrum trading and liberalisation will be applied to the existing mobile spectrum bands (both 2G and 3G bands); and
 - the enforcement of rollout obligations in the 3G operators' licences.
- 2.4 Figure 1 below shows the main Ofcom publications on spectrum policy issued over the past year, and how these relate to each other.

Figure 1. Spectrum strategy – key Ofcom activities



Bands covered in this document

2.5 This document discusses and sets out proposals for a large number of spectrum bands. These have been identified for inclusion in this document either because the particular band has the potential to be released by Ofcom into the market or because further discussion is needed in relation to the application of trading and liberalisation policies.

2.6 Table 2.1 below sets out the bands covered by this document and summarises the issues discussed in relation to each band.

Table 2.1 – Spectrum bands discussed in this document

Band	Issue Discussed	Relevant Sections & paragraphs
Part of 174 – 230 MHz (Band III)	Possible award in sub band 2 and 3. Ofcom has indicated in its publication Radio – Preparing for the future (December 2004) that it expects to consult in Spring 2005 on the timing of such an award	Section 5, paragraphs 5.2 – 5.13.
410 – 415 / 420 - 425 MHz	Possible award of 2 x 4 MHz	Section 5, paragraphs 5.14 – 5.29.
470 – 854 MHz	Brief discussion; Ofcom does not expect to bring proposals forward until after Regional Radio Conference in 2006	Section 5, paragraphs 5.30 – 5.34.
872 – 876 / 917 – 921 MHz	Possible award of 2 x 4 MHz	Section 5, paragraphs 5.35 – 5.50.
2G – GSM 900 band (880 - 915 MHz paired with 925 – 960 MHz)	Introduction of trading Liberalisation of the band Ability to use other bands to offer 2G services	Sections 8 and 9
1452 – 1492 MHz (L Band)	Possible award of 40 MHz	Section 5, paragraphs 5.51 – 5.60.
2G - GSM 1800 band (1710 – 1781.7 MHz paired with 1805 – 1876.7 MHz)	Liberalisation of the band Introduction of trading Ability to use other bands to offer 2G services	Sections 8 and 9
GSM/DECT guard bands (1781.7 – 1785 MHz paired with 1876.7 – 1880 MHz)	Plans to auction 2 x 3.3 MHz Detailed proposals for packaging	Section 5, paragraphs 5.61 – 5.95.
1790 – 1798 MHz	Possible award of 8 MHz	Section 5, paragraphs 5.96 – 5.112.
3G - IMT-2000 Bands (1920 – 1980 MHz paired with 2110 – 2170 MHz plus 1900 – 1920 MHz)	Introduction of trading Liberalisation of the band Ability to use other bands to offer 3G services	Sections 8 and 9
2010 -2025 MHz	Plans to auction 15 MHz	Section 5, paragraphs 5.113 – 5.140.
2290 – 2302 MHz	Plans to auction 12 MHz	Section 5, paragraphs 5.141 – 5.156.
2302 - 2310 MHz	Possible award of 8 MHz	Section 5, paragraph 5.157.

2500 – 2690 MHz	Plans to auction 2 x 70 MHz plus 50 MHz	Section 5, paragraphs 5.158 – 5.177.
3.4 GHz	Removal of restrictions in existing licences	Section 8
3.6 – 4.2 GHz	Possible award of available spectrum	Section 6, paragraphs 6.7 – 6.17.
10 GHz	Plans to auction 1 national licence of 2 x 100 MHz	Section 6, paragraphs 6.18 – 6.30.
28 GHz	Plans to auction 27 regional licences of 2 x 112 MHz	Section 6, paragraphs 6.31 – 6.64.
32 GHz (remaining 2/3 rd of the band)	Plans to auction 1 national licence of 2 x 500 MHz or 2 national licences of 2 x 250 MHz	Section 6, paragraphs 6.65 – 6.76.
40 GHz	Possible award of 2 x 250 MHz	Section 6, paragraphs 6.77 – 6.94.

2.7 See discussion in the relevant Section for details of relevant frequencies, timing and other issues.

Issues and bands not covered by this document

2.8 This document does not cover all aspects of the implementation of the SFR. The issue of ultra wide band (UWB) is the subject of a separate consultation document. The SFR also raises a number of issues which we expect to require further discussion and possibly further consultations before they can be implemented. These include:

- The possible use of higher power in licence-exempt bands in rural areas.
- The development of technology-neutral spectrum usage rights.
- Noise measurement methodologies to track changes in the noise floor.

2.9 This is not a complete list of issues and others may emerge as a result of the consultation exercise around the SFR. None of these issues are included within this document: instead we expect to issue separate guidance and possibly consultation in the coming year.

2.10 This document also does not cover all aspects of the implementation of spectrum trading and liberalisation. It focuses on the extension of trading and liberalisation to 2G and 3G mobile services.

2.11 Ofcom's timetable for the phased introduction of spectrum trading was set out in the Trading Statement and is summarised in table 2.2 below which sets out the plans by licence class.

Table 2.2 Timetable for phased introduction of spectrum trading

2004	2005	2006	2007	Other
Analogue Public Access Mobile Radio (PAMR)	Wide area Private Business Radio (PBR)	Emergency services	2G and 3G mobile	Mobile satellite
National paging	On-site PBR		Programme Makers and Special Events (PMSE)	Satellite shared with terrestrial services
Data networks	Digital PAMR		Aviation and maritime communication	Radio broadcasting
National and regional PBR	10 GHz FWA		Radio navigation (Radar)	Television broadcasting
Common Base Stations	32 GHz			
Fixed Wireless Access (FWA)	40 GHz			
Scanning telemetry				
Fixed terrestrial links				

2.12 The steps necessary to extend spectrum trading to the licence classes listed under 2004 are now complete. Work is also already in hand to extend spectrum trading to the licence classes listed for 2005. Aside from the issues related to mobile services (discussed in this document), Ofcom is also actively engaging with the issues that need to be resolved before spectrum trading can be introduced for the other licence classes listed for later years. Ofcom will consult on these issues, as appropriate during 2005 and beyond. In some cases, the timing of the introduction of spectrum trading is dependent on the successful resolution of matters that are not entirely within Ofcom's control. This timetable is therefore subject to review and possible subsequent change.

2.13 In relation to licence classes other than the 2G and 3G classes addressed in this document, Ofcom envisages a rolling programme of work to resolve a range of policy issues that will need to be addressed before final decisions can be taken on the extension of trading. This includes, for example, further work on the best way of managing spectrum used for PMSE, as well as further work with sectors such as satellite operators, emergency services and broadcasting. Ofcom's aim is to take forward resolution of as many of these issues as possible in 2005/06, so that by the end of the year there is a clear statement of policy about the way in which trading and liberalisation will apply to these bands.

- 2.14 In parallel with spectrum trading, Ofcom has proposed a programme of spectrum liberalisation – the reduction or removal of unnecessary restrictions on the use that can be made of spectrum. In the Liberalisation Consultation Document, Ofcom set out proposals for a general approach to spectrum liberalisation, discussed how it might be applied in detail to three licensing sectors in 2004 and 2005 – business radio, fixed wireless access and fixed terrestrial links – and gave an indication of the developments that Ofcom anticipates beyond 2005, specifically the extension of spectrum liberalisation to other licence classes, and the further relaxation of unnecessary restrictions. Ofcom is currently reviewing the responses to that consultation and intends to publish a statement and guidance on spectrum liberalisation shortly.
- 2.15 The Mobile Satellite Service (MSS) bands at 1980 – 2010 MHz and 2170 – 2200 MHz are currently being reviewed within a CEPT project team (JPT MSS 2GHz). The aim of this project team is to review the current MSS framework for this band in Europe with a view to enabling the introduction of new innovative MSS systems. The timetable for producing any final deliverables is September 2005. Depending on the outcome of this review, Ofcom may need to bring forward proposals for future use of this band during 2006.
- 2.16 There are two other bands not discussed in this document where spectrum is potentially available for award. These are:
- Spectrum between 47 and 68 MHz (Band I). In the UK the allocation is mobile services, while in Europe it is used for television broadcasting.
 - VHF low band (68 – 83 MHz). In this band there is approximately 2 x 1.325MHz plus 12 simplex channels (12.5kHz).
- 2.17 These have not been included as Ofcom judged from past discussions that there was no interest in these bands. However if stakeholders are interested in these bands please respond accordingly to the consultation.
- 2.18 In addition other spectrum may become available as a result of the audit of Government holdings by Professor Cave. On 2 December 2004, the Chancellor of the Exchequer announced that he had "asked Professor Martin Cave to lead a comprehensive audit of public sector spectrum with the aim of releasing the maximum amount of spectrum to the market". Ofcom welcomes that announcement which is consistent with our intention, stated in the SFR (section 6.4), to explore the scope for releasing spectrum from major spectrum holdings. In view of the nature of the spectrum usage to be audited, we would expect the review to take a long-term view, with most potential benefits being realised after the specific spectrum releases addressed in this document. Ofcom is actively supporting Professor Cave's work.

Document structure

- 2.19 This document is structured into three main parts.
- 2.20 The first part provides background to the subsequent sections. It consists of this Introduction, Section 3, which sets out Ofcom's general approach to spectrum management and the legal framework for decisions which Ofcom will need to reach on the matters discussed in subsequent Sections, and Section 4 which explains Ofcom's general policy on awarding spectrum.

- 2.21 The second part discusses Ofcom's plans to release further spectrum into the market.
- Section 5 – provides details of Ofcom's plans to award spectrum in bands *up to 3GHz* over the next 3 years
 - Section 6 – provides details of Ofcom plans to award spectrum in bands *over 3GHz* over the next 3 years
- 2.22 The third part deals with a number of spectrum policy issues which relate to mobile services.
- Section 7 – provides a short account of the background to the existing allocations of spectrum to the mobile sector
 - Section 8 – discusses the liberalisation of bands that are *not* presently used for mobile services, so that they can be used to offer mobile services
 - Section 9 – discusses the extension of trading and liberalisation to bands that *are* presently used for mobile services;
 - Section 10 – discusses the 3G operators' rollout obligations
- 2.23 Finally Section 11 sets out in summary form the next steps that Ofcom proposes to take in relation to the issues discussed in this document.
- 2.24 Annexes A - C set out the process for responding to this consultation. Responses are due by 24 March 2005.
- 2.25 Annex D provides a summary of relevant responses received following Ofcom's consultation on trading and liberalisation.
- 2.26 Annex E sets out a number of RIAs for particular proposals in the document.
- 2.27 Annex F provides a glossary of terms used in this document.

Section 3

Ofcom's approach to spectrum management

Role of Spectrum

- 3.1 Radio spectrum is a major asset to the UK, and the appropriate management of this vital resource is essential to ensure that the interests of citizens and consumers are well served, and that services using spectrum continue to function and develop. The radio spectrum is used for many things, but the focus of this document is on its use in communication services.
- 3.2 Spectrum is a key input into the provision of electronic communication services and networks. It is used in the provision of both mobile and fixed telecommunication services to residential consumers and businesses and it is used to provide both television and radio broadcasting. In each case the relative importance of spectrum, compared to the other inputs, varies.

Transition to the new model of spectrum management

- 3.3 This section explains briefly the general changes in the approach to spectrum management in the UK that are now under way. These issues are discussed in greater detail in other publications in particular the SFR, Trading Consultation Document, Trading Statement and Liberalisation Consultation Document. Understanding this context is important: many of the specific issues discussed in this document arise as a result of the transition from the past to the new approach.

Past approach – “command and control”

- 3.4 Historically, spectrum has been managed in the UK through extensive and detailed regulation. The general approach was for the spectrum manager (the State or its agency), to decide on both the use of a particular band and the users who were allowed to transmit in the band. This approach can be characterised as “command and control” (see section 2 of the SFR for further details).
- 3.5 This approach was typically characterised by the following policies which left little or no role for the market to decide how the spectrum should be used or by whom:
 - Licences contained detailed prescription of the use that may be made of the spectrum, including the purpose to which it might be put. In some cases, the technology was also prescribed. Detailed technical restrictions prevented other uses of the resource.
 - Licensees had no right to trade licences or to transfer them to third parties.
 - In cases where the demand for spectrum exceeded supply, the State typically made new awards through comparative selection (beauty contests).
- 3.6 The “command and control” model has a long pedigree, and in many ways it has been successful. Over the past century, it has allowed the radio spectrum to be used by a wide variety of private and public sector users to the benefit of consumers and citizens. The approach was well suited to circumstances in which by and large the supply and demand for spectrum were in balance, and the

dominant users of spectrum were public sector. While there were relatively few uses and users, the spectrum manager could have a reasonably good understanding of the best use of spectrum and so could sensibly make decisions on spectrum allocation.

- 3.7 However, these are no longer the circumstances facing spectrum managers. In particular, economic and technological developments have led to an increasing variety of applications using spectrum and an increasing in-balance between demand and supply. This has required refinements in the way spectrum is managed and crucially this has involved making more use of market based mechanisms.
- 3.8 This has been an international phenomenon. Other countries, in particular the US, Australia and New Zealand have already taken significant steps towards a more market based approach. In Europe, considerable attention is being given to spectrum trading and liberalisation. The Radio Spectrum Policy Group, established by the European Commission, has recently adopted an Opinion on Spectrum Trading. This recognises the benefits of trading and favours a phased introduction. It considers that European harmonisation of spectrum use will secure maximum social and economic benefits providing it is sufficiently flexible, technology-neutral and dynamic enough to encourage innovation. The Group is undertaking further work on spectrum liberalisation.
- 3.9 In the UK the use of economic mechanisms began with the introduction of Administrative Incentive Pricing (AIP) in 1998, which attempted to reflect the economic value of spectrum in licence fees to incentivise more efficient use. A further important step was taken in 2000, with the first use of an auction in the UK to allocate spectrum to particular users.
- 3.10 In the UK the need for a more fundamental change in spectrum management was identified in the report by Professor Martin Cave for the Government in March 2002 ("Cave Report")¹. This report was generally endorsed by the Government² and formed to some degree part of the background to the Communications Act 2003 which provides much of the framework under which Ofcom manages spectrum.
- 3.11 The Cave Report and the Government Response proposed a number of major changes to spectrum management. The common theme was the need to make more use of economic mechanisms in order to secure optimal use of the spectrum. In particular, Cave suggested that a market based approach which involved the introduction of spectrum trading and liberalisation, combined with the auctioning of vacant spectrum held by the regulator. As explained further below, and in the SFR, Ofcom broadly supports the approach advocated by Cave.

New approach – more market based

- 3.12 As proposed by Ofcom in the Trading Consultation Document and subsequently in the SFR, Ofcom considers that the management of the radio spectrum can be carried out more effectively if market forces are harnessed to a significantly greater degree than in the past. Ofcom considers this approach will
 - promote efficient use of the radio spectrum by allowing spectrum to be transferred to and used by the user who values it most highly;

¹ <http://www.ofcom.org.uk/static/archive/spectrum-review/index.htm>

² The Government response is also published at the address above

- promote competition by increasing the availability of spectrum for use in the most valuable service; and
- facilitate economically valuable innovation as new users enter the market to offer new services.

3.13 Market forces have a role to play both in determining the use of a particular band and in determining who should have the right to use that band. As explained in the SFR, this does not mean that there is no role for the command and control approach to spectrum management but it does imply a much more limited role than hitherto. Ofcom recognises that it is vital to ensure that changes in the spectrum management regime do not lead to harmful interference.

3.14 The implementation of the new approach will result in a significant amount of de-regulation of spectrum as the number of restrictions (both in terms of who can use the spectrum and what it can be used for) which characterise existing wireless telegraphy licences are reduced. The new approach is primarily implemented through the development and implementation of three policies:

- Spectrum trading;
- Spectrum liberalisation; and
- Prompt release of unused spectrum into the market allowing maximum flexibility as to subsequent use.

Spectrum Trading

3.15 Spectrum trading allows the transfer of rights and obligations arising under licences³. It therefore allows the market rather than the regulator to determine who uses spectrum. Ofcom considers that spectrum trading will help to optimise the use of the finite spectrum resource for the benefit of UK citizens and consumers.

3.16 Ofcom's general policy in this area was set out in the Trading Statement. Ofcom has published a number of other documents to implement the policy in particular licence classes. In this document Ofcom discusses the extension of trading to the existing mobile bands (ie spectrum currently used for 2G and 3G) which was not dealt with in detail in the Trading Statement.

3.17 The implementation of spectrum trading involves the following principal elements (described in more detail in the Trading Statement):

- the making of trading regulations which authorise the transfer of rights and obligations under the licences for relevant licence classes;
- the modification of some licences to clarify the circumstances under which Ofcom may revoke such licences and the amount of notice that Ofcom will give in each case;
- the establishment of a transfer process under which Ofcom can consent to trades;
- a review of non-spectrum licence conditions to consider potential effects on the development of trading;

³ The term licences here refers to wireless telegraphy licences granted under section 1 of the 1949 Act.

- the continued application of AIP;
- the publication by Ofcom of information to facilitate the development of trading

Spectrum Liberalisation

3.18 Under the command and control approach to spectrum management, the use of a particular piece of spectrum was closely specified, restricting the technology that might be used and the type of service that might be offered. Under the more market based approach to spectrum management these restrictions are removed so far as possible. The objective of this approach is to let the market determine the most valuable use for a particular band.

3.19 In order to allow that to happen it is necessary to liberalise the use of bands. This means removing technology and usage restrictions in licences unless they are necessary for the efficient management of the radio spectrum. Some restrictions might be necessary to comply with international obligations or to ensure that neighbouring users do not suffer an unacceptable level of interference. Restrictions which would be removed might include provisions which require particular technologies to be deployed.

3.20 Through implementation of this process for spectrum liberalisation, Ofcom intends to move away from prescribing the use of spectrum, seeking to reduce or in some cases remove such restrictions. Ofcom believes that spectrum liberalisation will deliver benefits to UK consumers by allowing the use of spectrum to be changed more quickly to the applications that are most valuable. The introduction of spectrum liberalisation is in line with Ofcom's strategic approach to managing the radio spectrum and complements the introduction of spectrum trading.

3.21 Ofcom initially articulated its policy in this area in the Trading Consultation Document and then subsequently in more detail in the Liberalisation Consultation Document.

3.22 Ofcom has proposed to implement its policy of liberalisation in the following ways:

- to publish a package of specific licence liberalisation measures for 2005 as a first step in a rolling programme and outline the next steps that will be taken as part of that programme;
- to consider variations of individual licences following requests for change of use from licensees;
- to vary some entire classes of existing licence to make them less usage and technology specific;
- to publish guidance for licensees about the levels of interference (described as a "Spectrum Quality Benchmark") which will be used by Ofcom as a key criterion in deciding whether or not to allow the removal or reductions of restrictions and as a reference for Ofcom in resolving interference complaints.

3.23 In this document the application of this general policy on spectrum liberalisation to the existing mobile spectrum is discussed. This was not considered in the Liberalisation Consultation Document. As mentioned in Section 2, Ofcom in the process of considering the responses to that consultation document and plans to publish a statement shortly.

Releasing spectrum

- 3.24 The third dimension of the new market based approach to spectrum management relates to the release of spectrum into the market. Historically, under the command and control model, spectrum would typically only be released when the regulator had identified a particular use for it. Under a more market based approach, there would be a presumption in favour of releasing unused spectrum as soon as it became available and letting the market find a use. Spectrum trading and liberalisation should enhance the availability of spectrum, as it should allow reallocation of the resource to the most valuable use and user once it is in the market.
- 3.25 Ofcom considers this type of approach is preferable as it is more likely to lead to an optimal use of the radio spectrum and to do so more quickly. Accordingly, Ofcom plans to operate with a presumption in favour of releasing spectrum as quickly as possible, consistent with an orderly process, if it is returned to the regulator, or new spectrum becomes available. In particular, during the period of transition to the new approach to spectrum management, there may be occasions where spectrum will need to be recovered by Ofcom and then re-released, such as in the case of broadcast spectrum and digital switch over.
- 3.26 This document sets out Ofcom's plans to release unused spectrum which is currently available or likely to become available in the next few years.
- 3.27 Ofcom's proposed approach to the choice of method for the release of spectrum is discussed in detail in Section 4 below. In general, Ofcom proposes to use auctions as the principal means of assigning spectrum where demand is likely to exceed supply, as this approach is most likely to ensure that a particular spectrum band flows to its most valuable use. However, there may be occasions where, for strong public policy reasons, Ofcom may wish to specify a particular use, and to choose a different method of assignment such as comparative selection.

Moving from old to new

- 3.28 This new approach to spectrum management requires implementation. This has begun already, in particular in the case of the introduction of spectrum trading and liberalisation, but this work has not so far been comprehensive. This document is a further step in moving from the past approach to spectrum management to the new approach. It explains for a number of bands (See Section 2 paragraph 2.6 for a list) how the transition might be achieved.

Legal Framework

Powers to manage spectrum

- 3.29 This document discusses a variety of options and contains a number of proposals for how Ofcom should manage spectrum in relation to particular frequency bands. In legal terms the options and proposals could require Ofcom to carry out one or more of the following actions:
- Issuing new licences;
 - Removing regulatory constraints on existing spectrum licences
 - Revoking licences;
 - Giving licence exempt status to equipment in relation to particular frequencies;

- Issuing regulations on extending spectrum trading or other matters
- Making other licence variations; and
- Deferring a decision pending the availability of more reliable information.

3.30 Ofcom's powers to carry out these functions are set out in the Wireless Telegraphy Acts of 1949 and 1998 ("1949 Act" and "1998 Act" respectively), as amended by the Communications Act 2003 ("2003 Act"). In summary Ofcom has the following powers:

- Section 1(2) of the 1949 Act gives Ofcom the power to grant licences for the installation and use of wireless telegraphy equipment, subject to appropriate conditions. Ofcom has a general discretion under this provision to decide how to award a licence, including for example whether to use an auction mechanism (provisions in respect of which are set out in the 1998 Act);
- Section 1(4) of the 1949 Act gives Ofcom a general discretion to revoke or vary any wireless telegraphy licences by serving a notice in writing on the licence holder (or by way of general notice to licensees in a class);
- Section 1AA of the 1949 Act requires Ofcom to make regulations under section 1 of that Act exempting the use of particular apparatus from requiring a wireless telegraphy licence where Ofcom is satisfied that such use is not likely to involve any harmful interference with wireless telegraphy (as defined in section 19(5A) of the 1949 Act). Therefore, where Ofcom is satisfied, as a matter of fact, that use of particular apparatus is not likely to result in harmful interference, it should take steps to create exemption regulations under section 1 of the 1949 Act.

Duties and other considerations

3.31 In exercising Ofcom's powers to manage spectrum, Ofcom is required to secure a number of statutory duties and to take into account other considerations. These can be thought of as Ofcom's objectives or decision criteria which it must consider when making a particular spectrum management decision. These are set out in full in the 2003 Act, and in particular at sections 3, 4, and 154 of that Act. The most relevant objectives for the proposals discussed in this document are set out below.

3.32 Under Section 3 of the 2003 Act Ofcom's primary duties are to:

- further the interests of citizens in relation to communications matters (s3(1)(a)); and
- further the interests of consumers in relevant markets, where appropriate by promoting competition (s3(1)(b)).

In doing so, Ofcom should secure:

- the optimal use for wireless telegraphy of the electro-magnetic spectrum (section 3(2)(a));
- the availability throughout the UK of a wide range of services (section 3(2)(b));
- the availability throughout the UK of a wide range of TV and radio services which (taken as a whole) are both of high quality and calculated to appeal to a variety of tastes and interests (s3(2)(c)); and

- the maintenance of a sufficient plurality of providers of different TV and radio services (s3(2)(d));

and have regard to:

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

3.33 As the management of the UK radio spectrum is governed by the European Communications Directives, which aim to harmonise the regulations of electronic communications networks and services throughout the EU⁴, section 4 of the 2003 Act applies to the proposals discussed in this document. Section 4 requires Ofcom to fulfil the “six community requirements” set out in that section when managing the wireless spectrum in the UK. Of particular relevance are the following:

- The requirement to promote competition (section 4(3));
- The requirement to promote the interests of all persons who are citizens of the European Union (s4(5));
- The requirement to act in a ‘technology neutral’ way (section 4(6));
- The requirement to secure that Ofcom’s activities contribute to the development of the European internal market (s4(4)); and
- The requirement to encourage such compliance with international standards as is necessary for- (a) facilitating service interoperability; and (b) securing freedom of choice for the customers of communications providers. (section s4(9) and (10))

3.34 In addition to these general duties and considerations, section 154 of the 2003 Act sets out a number of specific duties which apply to the management of the spectrum. In summary these require Ofcom to have regard to:

- the extent to which the spectrum is available for use or further use (section 154(1)(a));
- the demand for use of spectrum (section 154(1)(b));
- the likely future demand for spectrum (section 154(1)(c));

⁴ Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services; Directive 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities; Directive 2002/20/EC on the authorisation of electronic communications networks and services; Directive 2002/22/EC on universal service and users’ rights relating to electronic communications networks and services; Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector.

- the efficient management and use of the spectrum (section 154(2)(a));
- the economic and other benefits that may arise from the use of wireless telegraphy (section 154(2)(b) ;
- the development of innovative services (section 154(2)(c)) ; and
- competition in the provision of electronic communications services(section 154(2)(d)).

3.35 If there is a conflict between these various duties, section 4 duties will prevail over sections 3 and 154 and section 3 will prevail over section 154.

3.36 There are also other important legal constraints on how Ofcom can manage spectrum. Of particular relevance to many of the proposals discussed in this document are the following:

- The requirement to comply with EU harmonisation measures;
- To respect Government spectrum usage in accordance with the UK Frequency Allocation Table;
- The requirements to ensure that any licence conditions (whether imposed or removed via a licence variation or in the grant of a new licence) satisfy the tests set out in section 1D(9) of the 1949 Act, namely that they are:
 - objectively justified in relation to networks and services to which they relate
 - not such as to discriminate unduly against particular persons or against a particular description of persons
 - proportionate to what they are intended to achieve; and
 - transparent.

3.37 In addition, Ofcom must comply with any direction issued by the Secretary of State relating to spectrum management (see in particular sections 5 and 156).

Regulatory impact assessments (RIAs)

3.38 Ofcom has a duty under section 7 of the 2003 Act to carry out RIAs. RIAs provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making and are commonly used by other regulators. This is reflected in section 7 of the Act, which means that generally Ofcom has to carry out RIAs where its proposals would be likely to have a significant effect on businesses or the general public, or when there is a major change in Ofcom's activities.

3.39 In accordance with section 7 of the Act, in relation to each of the proposals which are at an advanced stage of development Ofcom has set out RIAs (see Annex E also in some cases see the option assessment included with discussion of the relevant band).

Section 4

Policy on release of spectrum

- 4.1 One of Ofcom's spectrum policy objectives is to allow, wherever possible, spectrum to be managed through the market, using trading and liberalisation, unless it is clearly justified for public policy reasons to take a different approach. Where spectrum is not already in use in the market, Ofcom aims to release it as soon as reasonably practicable. Ofcom has now examined current spectrum usage to identify any bands that are vacant or expected to become vacant in the near future or are otherwise capable of supporting further use. Details of the bands identified and Ofcom's proposals for allowing their use for wireless telegraphy activity are set out in the following two sections.
- 4.2 The legal framework which governs the use of spectrum has been set out in Section 3. This legal framework requires Ofcom either to grant licences or make exemption regulations in order for any wireless telegraphy equipment to be lawfully used in particular frequency bands. Throughout this document, Ofcom refers to the process of awarding licences, or making exemption regulations, in respect of previously unused areas of spectrum as the "release" of spectrum. In deciding on whether and how to release a particular piece of spectrum Ofcom must consider its statutory duties. It should be noted that these do not include revenue raising considerations.
- 4.3 Ofcom's proposed approach to choice of method for the release of spectrum is discussed in detail below. However it is worth noting, at the outset, that Ofcom has a legal duty (in section 1AA of the Wireless Telegraphy Act 1949) to make regulations exempting particular equipment if it is satisfied that its use for wireless telegraphy is not likely to involve undue (harmful) interference. That duty means that Ofcom will only license the use of particular equipment for wireless telegraphy where that use could give rise to harmful interference to other users.
- 4.4 Ofcom has the discretion to choose the appropriate mechanisms for assigning available spectrum licences. However, it must ensure that the procedures to grant licences must be open, transparent and non-discriminatory, in accordance with Article 5 of the Authorisation Directive 2002/30/EC.
- 4.5 There are a number of assignment processes that Ofcom may use where it is appropriate to limit the number of licences on offer:
- a "first-come first served" basis;
 - comparative selection (also referred to as 'beauty contest'); and
 - auction.

Key considerations in each case are set out in table 4.1 below.

First come
first served

In first come first served, licences are assigned to applicants in the order of their application. This mechanism is appropriate where demand for spectrum does not exceed supply. Where spectrum is scarce assigning it in this way is unlikely to lead to the spectrum

	ending up in the hands of those best able to use it to the maximum economic advantage.
Comparative selection	<p>In a comparative selection, licences are assigned to the applicants that, in the regulator's judgement, best satisfy the selection criteria that it has set. This approach may be appropriate in some cases, where, for example on public policy grounds, spectrum is being assigned for a specific end use. However, in general it has a number of drawbacks which mean that it is unlikely to be appropriate for cases where the key objective is to maximise the chance of the spectrum being obtained by those best able to use it to maximum economic advantage.</p> <p>Evaluating bids may involve difficult judgements and can create significant risk that the process will not place spectrum in the hands of those best able to use it to maximum economic advantage.</p> <p>With the element of judgement involved in selecting the successful bidders there is perhaps an increased possibility of accusations from unsuccessful bidders that the selection procedure has not been objective, non-discriminatory and transparent. While any mechanism is open to legal challenge, experience with this approach (for example in the US) suggests that it is more susceptible to such challenges, which creates delays in the award of licences.</p>
Auction	<p>In auctions, a bidding process is used to award licences to those bidders prepared to pay most for them. Auctions are therefore likely to lead to the spectrum being assigned to users that value it most highly. However, to maximise efficient use of spectrum it is important that auctions are carefully designed and managed, and that they have the participation of well-informed bidders.</p> <p>A well managed auction ought to be an objective selection process that meets the requirements for openness, non-discrimination and transparent processes. The outcomes should therefore be more robust against legal challenge and appeal.</p>

- 4.6 Ofcom believes that, in general, auctions are the best mechanism for awarding licences where the nature of the spectrum available indicates that demand for licences is likely to exceed supply. A wide range of auction formats and rules are possible – small changes in these rules may significantly affect the extent to which Ofcom can satisfy its spectrum management policy objectives. To ensure that the benefits of auctions are achieved they need to be carefully designed and well run, with well informed bidders.

Auction design

- 4.7 There are many auction formats, each of which may be tailored to particular circumstances. An observation often made is that 'one size does not fit all'. Ofcom will look at the circumstances of each band that it plans to auction in deciding the most appropriate design for an auction.
- 4.8 One consideration that may affect the design of the auction is where there is an asymmetry of market power between likely bidders. This may deter entry and the auction will need to be designed in a way that takes account of this. The objective will be to ensure that the less powerful bidders have an equal chance of winning. This should encourage a competitive auction and help ensure that the spectrum is acquired by those who have identified the best use.
- 4.9 As for the particular formats, where a relatively simple process is all that is appropriate a single round sealed bid auction may be used. In other cases, where a number of licences are on offer that may be variously valued by bidders a simultaneous multiple round auction may be more suitable. Where there are varying requirements between bidders for licence packages, in terms of spectrum or geography, a combinatorial auction could be used, which would allow the bidding process to determine the most efficient packaging.
- 4.10 It is likely that Ofcom will employ a number of designs in its programme of spectrum awards over the next two to three years. It will engage specialist advisers to assist in developing these. In each particular case Ofcom will consult on the proposed detailed design before it is adopted.

Auctions in a liberalised and tradable spectrum market

- 4.11 Ofcom will explore for each auction it runs what the most appropriate auction format will be. In the UK there have been three spectrum auctions: for 3G licences (in 2000), 28 GHz Broadband Fixed Wireless Access licences (in 2000) and 3.4 GHz Public Fixed Wireless Access licences (in 2003). In each case the auction was a simultaneous multiple round auction (SMRA). Although this is the most commonly used format throughout the world for spectrum auctions it is not necessarily the most suitable in all circumstances. In deciding on the appropriate format Ofcom will aim to ensure that the auction results in an allocation of licences that will achieve the most efficient use of that spectrum through a process that does not call for excessive resources or impose disproportionate burdens on bidders. Auction designs will be no more complex than required to meet these objectives. Ofcom believes that there may be scope for making auctions simpler than those run in the past, especially where the licences to be awarded are likely to be of a lower value. Also the existence of spectrum trading may reduce the need for complex auctions designs. Following the award of licences the market can be relied upon, in due course, to re-allocate the rights to transmit under the licences, so that spectrum will eventually be transferred to its highest value use.

Question 4.1 Do you see scope for using simpler auction formats in the future than used in the UK in the past?

Licence term for auctioned licences

- 4.12 Following Ofcom's consultations on the introduction of spectrum trading it intends to vary certain licences, starting with those that have been made tradable in 2004, to give them a rolling term, with a five year minimum notice period for revocation on

the basis of spectrum management reasons. This will not apply to licences that have been auctioned: 3G licences have a 21 year term; 28 GHz fixed wireless access licences have a 15 year term; and, 3.4 GHz fixed wireless access licences have a potential 15 year term (an initial five year term, extendable for a further five years on each of the fifth and tenth anniversaries of the award). These terms were set in order to give certainty to bidders and to give licensees security of tenure for a period to allow them to recoup the costs of establishing their networks.

- 4.13 Ofcom is considering whether, in a liberalised and tradable spectrum market, future auctioned licences should be for a fixed term, a rolling term or a minimum term with a rolling extension. A fixed term would enhance clarity in defining the spectrum rights being auctioned and, by giving certainty of tenure, assist bidders in assessing their value. Introducing a rolling term would be a departure from earlier practice, where auctioned licences have not been subject to revocation on spectrum management grounds. Doing so now would make for consistency with what is proposed for other tradable licences, but it would clearly increase the uncertainty for bidders, who would need to take account of the risk of licence revocation before they had been able to fully realise the business plan underlying their bids. An approach that reduces this risk while, in due course, bringing auctioned licences into line with the generality of licences would be to set an initial minimum term and allow for this to be extended with a rolling term thereafter. The initial minimum term might vary between licence awards, but would be determined (as in the past) to allow a reasonable minimum period for recovery of investment.
- 4.14 If licences are auctioned with a minimum term followed by a rolling term, Ofcom believes that there is a case for imposing AIP once the minimum term has finished, ie during the period of the rolling term. This issue has not arisen in the past because licences were auctioned with fixed terms only and the fee paid at auction reflected the value of the licence during this fixed term. If however auctioned licences also include rights that are held on a rolling term basis, after the initial minimum term, it is important that the licence is held during this rolling term period on similar economic terms to other licences with rolling terms. Given that AIP applies to such licences this suggests that AIP should be imposed on the rolling term of an auctioned licence as well. For this combination of reasons Ofcom is currently minded to make it clear in any future award of a licence subject to rolling extension, that it is likely that AIP would be payable on any such rolling extension.

Question 4.2 Do you agree future auctioned licences be for a minimum fixed term with a rolling extension?

Question 4.3 If licences with minimum fixed terms followed by rolling terms are introduced, do you agree that AIP should be payable during the rolling term of a licence?

Well informed bidders

- 4.15 An important factor in making for a successful auction is to have well informed bidders. It is ultimately for bidders and potential bidders to take responsibility for deciding whether to enter an auction and how to develop bidding strategies but Ofcom will aim to provide essential information to allow potential bidders to make well-informed decisions. Some key aspects of this will be:

- Raising awareness – Ofcom will publicise details of forthcoming award processes, with the aim of stimulating awareness of the process and thus encouraging entry to the auction. The information in this document

represents the first stage in this process. More detailed information will be provided as Ofcom develops more fully its plans for each award.

- Information memorandum – The information memorandum for an auction is designed to give bidders as much information as necessary for them to decide whether to enter the auction and how they would prepare for participation.
- Auction website – the information memorandum may be modified or complemented by the publication of updates and answers to specific questions. Such information will be posted on a dedicated part of the Ofcom website. The website will also contain full information on the progress of each auction.
- Preparing bidders is a key activity in the immediate run up to an auction. Training may involve a seminar covering auction procedures and software familiarisation. Unless the auction design is straightforward mock auctions may be needed to familiarise the bidders with the auction and, if necessary, to test the bidding system and communications with the bidders.

Question 4.4 What should Ofcom do to ensure that bidders are well informed and well prepared to participate in an auction?

Programme of spectrum awards

4.16 The following two sections set out Ofcom's proposals for releasing bands over the next two to three years. The programme of awards – their timing and sequence - needs to be carefully thought out. Some of the bands will be related, being capable of supporting identical or similar services – i.e. they will be substitutes. The activity in, and outcome of, one auction may influence bidder behaviour and valuations in another. Bidders may also need time between awards to re-assess their strategies and available resources. Ofcom's proposed programme is set out in table 4.2.

4.17 Ofcom considers the main factors to take into account in devising its auction programme are:

- Market interest – are potential bidders interested in early release of spectrum or is interest likely to be stronger at some later date?
- Economic significance of the spectrum - how large are the gains to consumers likely to be from the release of the spectrum?
- Overseas activities – do other countries, especially in Europe, plan to award licences (by auction or not) within the timescale under consideration? Would this impact on bidders' resources?
- Preparedness – when will the relevant technical and policy issues (if any) be resolved? How long will it take to be in a position to invite applications? Are potential bidders likely to be ready to participate?

- Services that the spectrum might support – where substitutable bands are to be auctioned bidders might be faced with difficult choices on which to bid for. Running auctions in parallel, with some bidding linkage, would allow bidders to switch between bands if they wished. However, this is a much more complex auction design and more demanding in terms of Ofcom’s resources. Alternatively the auctions could be run in a sequence that is notified in advance, which should help bidders in their choice.
- Ofcom’s resources – setting up and running auction properly is a resource intensive process

Question 4.5 Do you agree these are relevant consideration which Ofcom should take into account in devising its programme of spectrum awards?

Proposed Award Programme

4.18 Table 4.2 below sets out Ofcom’s proposed award programme for most of the bands up to 3GHz over the next 2 years.

Table 4.2 –Award Programme up to 3GHz

Bands up to 3GHz	2005/06	2006/07	2007/08	Suggested Packaging
1781-1785 MHz/1876-1880 MHz (GSM/DECT guard bands)	•			2 x 3.3 MHz 3 or 6 concurrent low power national licences
2010-2025 MHz	•			1 national licence for 15 MHz
2290-2302 MHz	•			1 national licence for 12 MHz
410-415 MHz/420-425 MHz & 872-876 MHz/917-921 MHz	•			National or regional licences of 2 x 4 MHz & 1 national licence of 2 x 4 MHz
2500-2690 MHz		•		Yet to be decided but will be based on the European band plan of 5 MHz blocks of paired and unpaired spectrum
1452 -1492 MHz (L Band)		•		To be determined
1790-1798 MHz			•	1 national licence 8 MHz

4.19 It is important to stress that these timings are indicative only. Ofcom’s plans may change following this consultation. Ofcom also faces important external constraints in a number of bands, either because satisfactory arrangements may need to be agreed with public sector users (including the Civil Aviation Authority (CAA) and Ministry of Defence (MoD), or because decisions are needed at European level. As a separate matter, Ofcom has already indicated (see Radio – Preparing for the Future, published 15 December 2004) that it expects to consult on the timing of an award in Band III in Spring 2005.

- 4.20 In relation to the broadcast dividend spectrum (within 470 -854 MHz), Ofcom plans to make policy decisions after the Regional Radio Conference in 2006 and any award would not be until some time after then.
- 4.21 Ofcom also expects to make a number of awards in bands over 3 GHz during this period. During 2005/06 it plans to make further awards in 28 GHz and in the following year (2006/07) there is the possibility of an award in the 10 GHz band and possibly in 32 GHz. Similar caveats apply to the timing of these awards.
- 4.22 Meeting this award programme will be challenging for Ofcom and for stakeholders. However Ofcom believes that it is important that spectrum is released to the market as soon as possible to allow operators to determine efficient uses of the spectrum and so bring benefits to consumers and citizens.
- 4.23 Ofcom's aim is to release spectrum to the market as soon as practicable but in devising the timetable Ofcom has had to take into account the need to focus its own resources and to consider the demands that an intensive programme of awards could place on bidders. This has meant staggering awards over the next two years. It has given precedence to those bands where interest in obtaining licences is likely to be strong and/or where the technical and policy issues may either already be largely resolved or should be resolved within the planned timescale. It has also taken account of the synergies between bands. This applies in particular to the 2010-2025 MHz and 2290-2302 MHz bands, which might interest some potential bidders as paired bands and others as independent bands: auctioning them at the same time would allow for both approaches.
- 4.24 Ofcom has also tried where possible to ensure that of the bands which are available those which have the potential to be most economically significant are auctioned earlier than those which likely to be less important. The two clear cases where this is not proposed are the 2500 -2690 MHz and 470 -854 MHz bands. In the first case this is not feasible primarily due to the need to resolve EU policy regarding harmonisation of the band. In the second case this is necessarily on a longer timescale as its release is linked to the successful implementation of the Government's policy on digital switchover.

Question 4.6 Do you believe that the proposed award programme is appropriate?

Section 5

Potential spectrum awards up to 3GHz

- 5.1 This Section set out Ofcom's plans to grant licences to use spectrum which is available in bands up to 3GHz.

Part of VHF Band III (174 - 230 MHz)

Background

- 5.2 VHF Band III was used for television broadcasting in the UK until 1984, when 405-line television transmission ceased. Elsewhere in continental Europe and the Republic of Ireland it is still used extensively for television.
- 5.3 Following the cessation of the use of VHF Band III for television in the UK, sub-bands 1 and 2 were allocated for business radio services - Private Mobile Radio (PMR) and Public Access Mobile Radio (PAMR). These systems are used by a wide variety of users such as on-site security services and logistics. In 1993 an allocation in sub-band 3 was set aside for new land mobile technology and in 1994, 217.5 -230 MHz, was allocated for the use of digital radio broadcasting using Digital Audio Broadcasting (DAB) technology.
- 5.4 Notwithstanding these allocation decisions, a sizeable part of VHF Band III has remained under-utilised. Two of Ofcom's predecessor regulators, the Radiocommunications Agency and the Radio Authority, issued a joint consultation exercise on 17 October 2003, seeking views on opportunities for future use of spectrum in this and the 1.5 GHz bands. The public consultation responses identified a number of possible uses of the spectrum (the consultation and responses are available on the Ofcom website at http://www.ofcom.org.uk/consultations/past/vhf_band3/?a=87101).

Technical Characteristics

- 5.5 In VHF Band III (174-230 MHz), approximately 17 MHz of spectrum is currently available for new or existing allocations. The band is divided up as follows:
- sub-band 1 (174 – 191 MHz) - spectrum not available. It is currently allocated to business radio services
 - sub-band 2 (193 – 207 MHz) – some spectrum is available, but not contiguous. Some spectrum has been assigned to business radio services
 - part of sub-band 3 (209 – 225 MHz) - contiguous spectrum available within this range. There are some existing users in part of this sub-band - Programme Making and Special Events (PMSE) and short range devices.
 - 217.5-230 MHz - spectrum not available. This upper part of VHF Band III was allocated to Terrestrial Digital Audio Broadcasting (T-DAB) in 1994.
- 5.6 The available spectrum in sub-bands 2 and 3 is distinguished by whether it is contiguous or not and this has an impact on the effectiveness or costs in making the spectrum available. Some services may need non-contiguous spectrum to be re-farmed before it is usable.

Constraints

- 5.7 Sub-bands 2 and 3 are subject to international constraints on their usage. At a European level, the use of VHF Band III is coordinated around broadcasting use. This means that for the UK to allocate this spectrum to non-broadcasting uses, it has to ensure that these services will not interfere with broadcasting transmissions in neighbouring countries. It also means that UK services are not protected from broadcasting transmissions in other countries.
- 5.8 In practice, the UK has negotiated bilateral agreements with France, Belgium and Holland, and an informal agreement with the Republic of Ireland. These cover coordinated use of mobile services in the UK in sub-band 2 (but not sub-band 3) and detail specific technology and / or applications to be used.
- 5.9 The use of VHF Band III will be reviewed at the Regional Radio Conference (RRC) in 2006 and a new digital broadcasting plan will be produced. Existing assignments (to mobile and T-DAB) should continue to be protected, but any new proposals for use of VHF Band III may be constrained by what is decided at the RRC, where the objective is to produce an international plan for broadcasting.

Option assessment

- 5.10 The 2003 consultation was followed by an economic analysis of the options for using VHF Band III. External consultants, Analysys, DotEcon and Mason assessed the economic benefits of various allocation options, taking into account technical limitations on services sharing the same spectrum blocks. Their findings (also available on the Ofcom website) are that the economic value of the spectrum will be maximised by allocating capacity in sub-band 2 to PMR/PAMR and in sub-band 3 to T-DAB.

Proposal

- 5.11 Ofcom's proposal for the available spectrum in VHF Band III is to allocate it as follows:

- sub-band 2 should be allocated to services compatible with the technical configurations for PMR and PAMR
- sub-band 3 should be allocated to services compatible with the technical configuration for T-DAB

- 5.12 Further details on the proposed allocation and assignment of sub-band 3 were announced in Radio – Preparing for the future published by Ofcom on 15 December 2004.

- 5.13 The proposals for sub-band 3 are subject to:

- finding a solution for existing users of the VHF Band III sub-band 3 spectrum (PMSE users) and the costs of relocating them being less than the benefits of DAB use. (Note: PMSE spectrum is used, in sub-band 3, for purposes such as radio microphones by broadcasters, theatres etc); and
- securing international agreement on the use of this band, which will be reviewed at the RRC in 2006, so that UK services can operate without interference.

Question 5.1 Do you agree with these proposals for the award of Band III?

Part of 410 – 425 MHz (410-415 MHz paired with 420-425 MHz)

Background

5.14 Frequencies in this band were licensed to a company within the Inquam group for the national provision of a public telecommunications network (the Dolphin network) using TETRA 1 technology. TETRA is a digital professional two-way radio standard developed by the European Telecommunications Standards Institute which includes advanced speech and data facilities, wide area coverage and greater immunity from interference and eavesdropping. Following the operating company's entry into administration, the licences were revoked in July 2004. The Dolphin TETRA 1 network in this band has now been closed down.

Description

- 5.15 The band is managed by MoD and civil use is by their agreement. Military use continues in the band and Ofcom is discussing with MoD the most suitable channelling arrangements that would optimise future civil use while safeguarding military use.
- 5.16 The need to co-ordinate civil and military use is likely to put substantial constraints on use above 420 MHz, particularly in northern England. There are also more localised restrictions around some military sites in other parts of the UK: these latter restrictions may be lifted through negotiation between the eventual licence holder(s) and MoD.
- 5.17 The spectrum released for Dolphin was 160 non-contiguous 25 kHz duplex channels. Ofcom is discussing with MoD the possibility of reconfiguring the channels into contiguous blocks. There are essentially two options: a 4 MHz block in each of the sub-bands 410-415 MHz and 420-425 MHz; or a contiguous 8 MHz block from the band 410-420 MHz. With the first option there are two variants: one with the downlink in the upper sub-band and uplink in the lower, and the other option reversing this. The latter might help alleviate the impact of military use but would also be the reverse of use elsewhere in Europe and so be susceptible to interference from users on the continent.
- 5.18 A number of ECC Decisions are relevant to this band: ERC/DEC/(96)04 on the frequency bands for the introduction of TETRA; ECC/DEC/(02)03 on the availability of frequency bands for the introduction of narrowband digital land mobile PMR/PAMR; and ECC/DEC/(04)06 on the availability of frequency bands for the introduction of wide band digital land mobile PMR/PAMR systems in the 400 MHz and 800/900 MHz bands. Under the new ECC Rules of Procedure, the UK is shown as having not implemented any of these Decisions. Ofcom preference is to award the spectrum on a technology and service neutral basis.
- 5.19 The band might also be seen as a candidate for relocating current users in the 450-470 MHz (UHF2) band. The current UK configuration of the UHF2 band is mis-aligned with Europe. This means that it is prone to continental interference, and in its current structure it provides little scope for meeting new demands and facilitating new technologies. The RA intended to address these problems through its Band Alignment Project, which involved moving, over a period of time, spectrum blocks within the band as some blocks became vacant with the migration of the Emergency Services at the end of 2006. On 21 July 2004, Ofcom announced its decision to abandon the project and rely on market mechanisms to effect the re-organisation of the band.

Options assessment

5.20 Besides the spectrum configuration, Ofcom has considered six options for future civil use in the band:

- award regional licences, beginning with a licence for London;
- auction a national licence;
- reserve part of the band for emergency services and for business radio use;
- re-consider the options as part of a wider review of the UHF bands (410-470 MHz);
- license on a first come first served basis; and
- award the spectrum to a band manager.

Regional licences

5.21 There has been some interest shown in a licence exclusively for London. This appears to be an attractive business proposition. Co-ordination with military use would impose lesser constraints than those imposed on use further north. However, because of the nature of the co-ordination mechanism, operations in London would limit civil use in other areas – the more intensive the use in London the less the possibilities for use elsewhere.

UK licence (England, Scotland, Wales and Northern Ireland)

5.22 In an environment where trading and licence liberalisation are possible a UK licence would maximise the incentive for the licensee to use the spectrum efficiently and so derive full economic value from the spectrum. A UK licence would also allow the spectrum user to weigh its business interests against the constraints imposed by military use, i.e. it would be able to assess the optimal geographic roll-out of services.

Allocate spectrum for emergency services and business radio use

5.23 There are numerous requirements from emergency services users and from other users who wish to adopt narrowband digital technology for business radio on-site operations. No spectrum is presently available for such use. Ofcom has estimated that no more than 2 x 2 MHz would need to be set aside in this band for emergency services and 2 x 200 kHz for business radio. The remainder might be allocated nationally or regionally as suggested above. Alternatively, such users could acquire such spectrum via the market, for example through trading.

Consider as part of a wider review of UHF

5.24 Ofcom announced on 21 July its decision to rely on market mechanisms to effect the re-organisation of the UHF2 band (450-470 MHz), having abandoned the band re-alignment project. The relocation of current users in the band to 410-430 MHz could assist in the reorganisation of UHF2 and proposals for civil use in the lower band could take this into account.

License on a first come first served basis

5.25 There are diverse possibilities for use of the band, including public access mobile radio, private business radio, emergency services and programme making, many of which would operate in restricted localities or possibly over wider areas, but not nationally. This might suggest that licences should be offered on a first come first

served basis for users to obtain as and when they required access to spectrum. Ofcom would need to co-ordinate use, both to protect military users and to prevent interference between civil users. Licences would be, so far as technically possible, service and technology neutral.

Award the spectrum to a band manager

5.26 The band could be awarded to an organisation acting as a band manager. The band manager would itself be a licensee of Ofcom but have the ability to give third parties access to rights on a commercial basis. The role of the band manager is in some ways similar to the role Ofcom currently performs in assigning spectrum to individual uses but the band manager would be free to develop innovative ways of assigning the spectrum in the light of its perception of market demands. The initial spectrum award would be by a competitive process, probably an auction.

Proposal

5.27 In line with its general approach to releasing spectrum, Ofcom's provisional view is that the award by auction of a single UK licence, without unnecessary constraints on the service to be provided or technologies to be used, would be consistent with the need to secure the optimal use of the available spectrum. However, it recognises that, given the variety of potential uses for the spectrum, the other options need to be carefully considered. It is undertaking further work to determine the most appropriate approach to awarding this spectrum: with the assistance of external consultants, it is analysing the business potential of the band and the technologies that might be employed. This analysis will inform both the spectrum packaging, licence conditions and award process and will help ensure that Ofcom's detailed subsequent proposals for the award and the licence product are those most likely to meet its statutory duties and other considerations. The spectrum package will be finalised following the completion of discussions with MoD.

5.28 Subject to the outcome of the market study and responses to this consultation Ofcom's proposal is to make an award in 2005/06. Preparations will begin after the completion of this consultation. Ofcom will publish details of the spectrum on offer, the award process and other relevant information to allow interested parties to decide on their approach to the award.

5.29 Ofcom will need to take into account its duty to promote the European internal market alongside its other duties which require it to avoid unnecessary restrictions in the licences it grants which limit the potential uses of the spectrum.

Question 5.2 Do you agree Ofcom should award a national licence on a technology and service neutral basis by auction or is there another option for award that is more likely to meet users' requirements?

Question 5.3 Do you think that spectrum in the band should be allocated for emergency services and business radio use?

470- 854 MHz Broadcast Dividend

Background and Description

5.30 The UHF frequency range currently used for analogue and digital TV will be substantially rearranged when analogue TV is replaced by an all-digital system. From a UK perspective, it has been estimated that 112 MHz of spectrum could become available, in four sub-bands of width respectively 40, 8, 16 and 48 MHz

(equating to TV channels 31-35; 37; 39-40 and 63-68. TV channel 36 is dedicated to the aeronautical radar service in the UK and TV channel 38 to Radioastronomy).

- 5.31 However, international frequency sharing considerations will apply. Specifically, an international conference, the Regional Radio Conference (RRC) in May 2006, will establish a plan for frequency use throughout Europe, Africa, and the Middle East, at which the extent of the international constraints will be clarified. The plan will be based around all-digital broadcasting, as opposed to the present mixed analogue and digital TV environment. In addition to the new plan itself, constraints accruing from continued use of analogue TV in countries neighbouring the UK will continue until these signals are switched off. Each country will pursue its own switch-off plan.
- 5.32 For the purposes of establishing a strategy for use of this part of the spectrum in the UK, Ofcom is assuming this spectrum will not be required to sustain digital switchover. However until the RRC concludes its deliberations in 2006 it is not possible to be sure what capacity will be available for assignment, and what constraints may exist on its use.

Policy Options

- 5.33 The technical characteristics of this spectrum make it capable of use for a significant variety of services (broadcasting, mobile communications, multimedia, etc.). The greater economic and technical efficiency of spectrum use in the all-digital environment is one of the principal drivers behind the digital switchover project. Ofcom's report *Driving Digital Switchover* identifies examples of possible use, including " ..to provide additional broadcasting services such as extra digital terrestrial TV channels, more radio services and interactive services. Alternatively, the existing broadcasting transmitters could be used to send TV and some other forms of data to mobile devices. Provided the necessary international agreements were secured, the freed spectrum could ultimately supply the capacity for entirely new wireless communications services, such as mobile wireless broadband. "
- 5.34 At this stage, Ofcom has not undertaken a detailed review of alternative policy options. It plans to do this when it has some clarity regarding the international constraints and therefore it will do this after the RRC in 2006.

Question 5.4 Do you believe it is appropriate wait until after the RRC in 2006 before developing policy proposals?

872 – 876 MHz paired with 917-921 MHz

Background

- 5.35 Frequencies in this band were licensed to a company in Inquam group for the national provision of public telecommunications networks for its TETRA network, to provide a TETRA2 overlay system to their TETRA1 network in the 410 – 430 MHz band. TETRA is a digital professional two-way radio standard developed by the European Telecommunications Standards Institute which includes advanced speech and data facilities, wide area coverage and greater immunity from interference and eavesdropping. Following the operating company going into administration, the licences were revoked in July 2004. At the time of revocation the Dolphin TETRA 2 network had not been rolled out.

Description

- 5.36 The assignment is 2 x 4 MHz of spectrum with 45 MHz duplexing, from 872-876 MHz paired with 917-921 MHz, available nationally. This spectrum is adjacent to the GSM 900 band and may offer opportunities to provide GSM services from this band. It is free of incumbent users and is thus available immediately to support new uses.
- 5.37 Two ECC Decisions are relevant to this band: ERC/DEC/(96)04 on the frequency bands for the introduction of TETRA; and ECC/DEC/(04)06 on the availability of frequency bands for the introduction of wide band digital land mobile PMR/PAMR systems in the 400 MHz and 800/900 MHz bands. Under the new ECC Rules of Procedure, the UK is shown as having not implemented either of these Decisions. Ofcom preference is to award the spectrum on a technology and service neutral basis.
- 5.38 A number of technologies are used in bands adjacent to the two under consideration:
- Below 915 MHz - GSM uplink
 - Above both 876 MHz and 921 MHz – UIC (GSM-R)
 - Below 872 MHz – military use
 - Below 870 MHz – Short Range Devices
- 5.39 Ofcom's proposal is that future use in the band will need to protect networks using these technologies in adjacent bands from harmful interference. Adjacent band compatibility studies conducted in CEPT PT SE7 have concluded that filtering will be required to effect coordination.

Options assessment

- 5.40 Ofcom has considered either awarding regional licences or a single national licence.

Regional licences

- 5.41 Offering regional licences might correspond with the optimal business case for developing the spectrum but it would place co-ordination responsibilities on neighbouring operators which are likely to mean some loss in spectrum efficiency.

UK licence (England, Scotland, Wales and Northern Ireland)

- 5.42 In an environment where trading and licence liberalisation are possible a UK licence would maximise the incentive for the licensee to use the spectrum efficiently and so derive maximum economic value from the spectrum.

Proposal

- 5.43 Ofcom's proposes to award one UK licence. The licence would be tradable and partial transfers would be permitted under the Wireless Telegraphy (Spectrum Trading) Regulations 2004 to the maximum extent technically possible. There would be no constraints on the services to be provided or technology, subject to the need to protect other spectrum users in adjacent bands, international constraints and policy on the provision of 3G services.

- 5.44 Ofcom believes that this proposal is consistent with the need to secure the optimal use for wireless telegraphy of radio spectrum.
- 5.45 Granting a single UK licence is likely to lead to the most efficient use of the available spectrum. The licensee would not be constrained, as it would be if small area or regional licences were awarded, by the need to co-ordinate with its neighbours, which might sterilise the use of spectrum at regional borders. Assigning all the available spectrum in one licence would similarly obviate the need for guard bands between different users' assignments. With a national licence the licensee would also have more freedom to decide the most advantageous roll-out of services.
- 5.46 In line with Ofcom's general approach to the release of spectrum described in section 4, it believes that the auction of the available spectrum in this band should ensure that it is assigned to the operator who has identified the most valuable use for the spectrum and is most likely to make the most efficient use of it, in both commercial and spectrum management terms.
- 5.47 There are a number of potential uses for the spectrum, including public access mobile radio, private business radio and programme making. Ofcom has to take into account requirements to exercise its functions in a technology neutral manner; to have regard to all existing and potential demand for the spectrum and to facilitate the development of innovative services. Making the licence available with little or no constraint on service provision or technology would be consistent with this. It would allow the licensee to provide the most attractive services for potential customers and the opportunity to develop innovative services. Awarding this spectrum with the minimum of constraints could also reduce entry barriers associated with access to spectrum and so promote competition with existing service providers.
- 5.48 Ofcom will need to take into account its duty to promote the European internal market alongside its other duties which require it to avoid unnecessary restrictions in the licences it grants which limit the potential uses of the spectrum.
- 5.49 Ofcom is undertaking further work to determine the most appropriate way to award this spectrum. With the assistance of external consultants, it is analysing the business potential of the band and the technologies that might be employed. This analysis will inform both the spectrum packaging, licence conditions and award process and will help ensure that Ofcom's detailed subsequent proposals for the auction and the licence product are those most likely to meet its statutory duties and other considerations.
- 5.50 Subject to the outcome of the market study and responses to this consultation, Ofcom proposes to hold an auction in 2005/06. Preparations are likely to begin after the completion of this consultation. Ofcom intends to publish details of the spectrum on offer, how the auction will work and other relevant information to allow interested parties to decide on their approach to the award. Ofcom is also required to publish draft regulations setting out the auction rules; these will be subject to a statutory consultation period. Nearer the time of the auction Ofcom will offer bidders further information and, if necessary, training in the intended auction process, including any IT systems that might be employed.

Question 5.5 Do you agree Ofcom should award a UK licence on a technology and service neutral basis by auction?

L-Band (1452-1492 MHz)

Background

- 5.51 A potential plan for the packaging of L-Band spectrum was reflected in the UK's recognised plan agreed at the CEPT T-DAB planning conference in Maastricht 2002. This distributes the use of 16 frequencies across 276 separate contiguous but non-overlapping allotment areas (an allotment is equivalent to the coverage area in which there are rights to transmit and protection from interference). These areas are much smaller than the equivalent service areas for T-DAB using VHF Band III, partly because the signals do not carry as far at the higher L-Band frequency. Ofcom, however, is not bound to follow the Maastricht 2002 frequency plan for L-Band provided that any deviation from it would not increase potential interference to neighbouring countries. The conditions of the Maastricht agreement allow for a significant departure from the plan as originally agreed.
- 5.52 L-Band spectrum can be used to deliver not only radio broadcast services, but also a combination of video, audio and data services. Services can also be delivered as mobile services or to fixed and portable devices.

Technical Characteristics

- 5.53 In the L-Band, all 40 MHz of the spectrum will become available from 2007, when the existing users, fixed point to point links, will have their licences revoked and are due to vacate the spectrum. For the purpose of T-DAB planning at CEPT level, the band was divided into 23 x 1.5 MHz frequency blocks (plus guard bands between each block). The lowest 16 blocks were allotted to T-DAB. The remaining seven blocks can be considered for future satellite Digital Audio Broadcasting (SDAB) development.

Option assessment

- 5.54 This frequency range could potentially be used for radio broadcast services. The European frequency plan is based on this assumption, and is optimised to this use, including the T-DAB standard. Some T-DAB receivers tune to this range, largely in recognition of a potential wider European market. However, the characteristics of the frequency range also make it suitable for mobile communications services and 'broadcast multi-media' (including mobile TV and data information services). The challenge for aspiring providers of services other than T-DAB would be to establish a market where consumer or other user devices are (at least initially) UK-specific in terms of the combination of system and frequency.
- 5.55 Ofcom's current assessment is that the opportunities to use L-Band for commercial broadcasting could be absorbed within a standard application- and technology-neutral market allocation process, rather than requiring an intervention to secure it. A study commissioned by Ofcom of the options for allocating L-Band (and Band III) spectrum⁵ supports this view. It found that multimedia could generate sizeable economic benefits, but that there was a great deal of uncertainty particularly over technology. It also found that there was a potential demand for the spectrum from radio broadcasting and proposed a technology-neutral allocation process to let the market decide how to allocate the spectrum.

⁵ Assessment of options for allocating available spectrum within VHF Band III and L-Band, Analysys, dotEcon.

5.56 Responses to the consultation in 2003 on future use of L-Band spectrum⁶ suggested that some of the spectrum be reserved for community radio. It is possible that these frequencies might represent the best opportunity to address public policy requirements for small-scale and community sound broadcasting on a digital radio platform. However, there are also reasons why they might not, notably:

- the DAB multiplex structure is not well aligned to the technical requirements of these broadcasters, whose coverage footprints tend to be unique rather than shared with others; thus the costs of transmission cannot be shared between users as is usually the case for DAB digital radio;
- the timescale over which digital broadcasting in this form might be economically viable, let alone an imperative, for these broadcasters is very difficult to estimate, increasing the relevance of other media/technologies as alternatives.

Proposal

5.57 Ofcom's initial proposal is to allocate all 40 MHz of spectrum on a technology and application-neutral basis, with associated rights of spectrum trading. There are various ways in which this 40 MHz might be package. One option would be to divide it up as follows:

5.58 The rights to use the 12 MHz allocated to satellite broadcasting might be auctioned as a single licence, subject to constraints to protect reception of those satellite services in neighbouring countries. Rights may, if a bidder wishes, be in the form of Recognised Spectrum Access (RSA), i.e. to protect a broadcast satellite service.

5.59 The remaining 28 MHz might be auctioned as more than one sub-band, to enable the establishment of a competitive environment in the provision of particular types of service, including the potential for licensees to choose their preferred technology (e.g.DMB or DVB-H for multimedia broadcasting).

5.60 The auctions could take place in 2006/07.

Question 5.6 Do you think Ofcom's proposal is appropriate?

1781.7 – 1785 MHz paired with 1876.7 – 1880 MHz (GSM/DECT Guard Bands)

Background

5.61 These bands present a unique set of circumstances. They are currently largely unassigned but fall within the operating range of standard GSM mobile phones. These phones are widely available, huge numbers are in the hands of the public, and new phones are cheap to acquire.

5.62 When the original GSM 1800 assignments were made, the technical advice was that 1876.7 – 1880.0 MHz should be kept clear to provide a guard band to protect GSM 1800 services from interference from Digital Enhanced Cordless Telecommunications (DECT) systems and vice versa. However, more recent

⁶ Opportunities for future use of spectrum within VHF Band III (174 to 230 MHz) and in the 1.5 GHz Band (1452 to 1492 MHz) October 2003, Radiocommunications Agency & Radio Authority

technical work (ERC Report 100 and Ofcom's own analysis) has indicated that a guard band is no longer necessary provided that certain technical constraints are imposed.

- 5.63 The 1781.7 – 1785.0 MHz paired band is currently available but there is some MoD use. In accordance with the UK Frequency Allocation Table, MoD operates transmitting earth stations at one or more of the following sites: Menwith Hill (Yorkshire), Oakhanger (Hampshire) and Colerne (Wiltshire) in or close to the lower band (1781.7 – 1785 MHz). Commercial operations in this band will have to accept any interference caused by these earth stations.

Description

- 5.64 The bands under consideration form part of the overall GSM 1800 spectrum, 1710 – 1785 MHz paired with 1805 – 1880 MHz. This spectrum was identified in ERC Decision (95)03 for the provision of mobile telephony services based on GSM technology.

- 5.65 Following approaches by a number of interested parties, the RA consulted on the future use of the band in mid 2003⁷. The consultation proposed 3 possible scenarios:

- to make the spectrum available, on a national or regional basis, to either the existing GSM operators or to new entrants for the provision of public mobile telecommunication services;
- to make the spectrum available for short-range, low-power use on a licence-exempt basis; or
- to retain the guard band and leave the paired band unassigned, in order to assist migration of GSM 1800 to future IMT-2000 use and to facilitate Test and Development licensing.

- 5.66 A large number of responses supported the option of making the band available for low-power (licence-exempt) GSM use. The incumbent GSM operators and some equipment manufacturers favoured traditional wide area use or keeping the spectrum vacant to facilitate migration of 2G services to 3G⁸.

- 5.67 In order to quantify the benefits of the three scenarios better, and in particular low-power GSM use, Ofcom commissioned an economic study by NERA. The NERA report "GSM guard bands economic impact study, July 2004"⁹, indicated a significant market opportunity for exciting and innovative new services to develop if the bands were made available for low-power GSM. The NERA report estimated a net present value of £943m for low-power GSM use over 10 years. Much lower economic benefits would flow from leaving the spectrum unassigned (£82m) or licensing it for wide-area GSM (£128m).

- 5.68 In Ofcom's opinion the NERA study over estimated the likely benefits of the low power option. There is some doubt over the robustness of the take-up and revenue forecasts in several of the scenarios in NERA's model. However, we believe that

⁷ Use of the 1781.7-1785.0 / 1876.7-1880.0 MHz Bands for the Provision of GSM 1800 Telecommunications Services, April 2003

⁸ http://www.ofcom.org.uk/consultations/past/ra_condoc_2g3g_spectrum/?a=87101

⁹ http://www.ofcom.org.uk/consultations/past/ra_condoc_2g3g_spectrum/gms.pdf

this study provides sufficient evidence to indicate that the benefits of the low power option are at least as great as the wide area option.

Options assessment

- 5.69 Ofcom has considered a number of options for the future use of this spectrum, in addition to traditional wide area use, and there appears to be a significant opportunity to use the band for a range of innovative services based on low-power GSM. In this context, “low power” is defined as being restricted to 200 mW EIRP.
- 5.70 In Ofcom’s opinion, it is unlikely that there is enough spectrum for a new entrant to offer a stand alone wide-area GSM service in competition to the incumbent 2G operators. However, the spectrum may well be an attractive addition to the existing operators to provide extra capacity.
- 5.71 The viability of new services is subject to a number of technical issues. One of the main applications identified is the provision of cordless phone services to corporate customers. Ofcom studies based on a low-power scenario indicate that providing coverage and capacity in a typical office building of 4 or more floors could require up to 8 radio channels, approximately 50% of the available spectrum. Adjacent buildings deploying such systems on the same radio channels could suffer a 1 in 4 call failure rate. Reducing the call failure rate to 1 in 10 would require the buildings to be 130m apart if there were no obstructions between them. In a business district therefore, providing this type of service using low-power GSM would be feasible but would require co-ordination. In a domestic environment, a single radio channel per dwelling should provide sufficient capacity and coverage, and provided this could be re-used after 14 houses or fewer, frequency selection should be a relatively simple task but a co-ordinated approach is still recommended.
- 5.72 On the basis of the above we conclude that purely uncoordinated (i.e. licence-exempt) systems are not an attractive option. There is a high risk of interference between users if deployment is not managed.
- 5.73 Various scenarios for awarding the spectrum have been considered. These range from a single UK high power licence; to combinations of splitting the band to provide two high power licences or one high power plus a number of low power licences; to regional low power licences; to concurrent national low power licences and to licence exemption. The main scenarios considered are summarised below.

Maintaining the spectrum unassigned

- 5.74 A ‘do nothing’ option would delay this spectrum being used for productive purposes for many years resulting in a loss to the UK economy.

One UK licence

- 5.75 One high or low power (at choice of the licensee) UK licence.
- 5.76 Technically this scenario is viable from the interference management point of view. There is likely to be good demand for the spectrum for either congestion relief by an MNO or for innovative applications by an MNO or new entrant.
- 5.77 However, in the low power scenario competition would be limited unnecessarily by the existence of only one licence. The choice within the market between high and low power applications may be affected by any disparity in market power between different potential bidders, which may lead to less than optimal use of the spectrum.

Two national licences

- 5.78 One high or low power (at choice of the licensee) UK licence and one low power (due to power constraints above 1878 MHz) UK licence split by frequency.
- 5.79 Technically this scenario is viable from the interference management point of view but planning in business districts may be difficult. There is likely to be less demand for spectrum than a single national licence due to the additional complexity and the limited amount of spectrum (particularly if high power use is chosen for one of the licences).

One national and two or more concurrent licences

- 5.80 One high or low power (at choice of the licensee) UK licence and two or more concurrent low power (due to power constraints above 1878 MHz) UK licences split by frequency.
- 5.81 The interference management implications of this arrangement are likely to be problematic, particularly in business districts. The degree of difficulty in managing interference will depend on the number of concurrent licensees but co-ordination amongst the parties will be a material consideration on the viability of some of the business cases.
- 5.82 This scenario provides potential for new entrants to obtain low power concurrent licences but co-ordination issues are significant and may undermine interest in the spectrum.

Regional licences

- 5.83 One high or low power (at choice of the licensee) licence per region.
- 5.84 Interference management would only be problematic at regional borders. However for high power use there may be a need for significant separation distances at borders thus potentially denying services to some parts of the UK.
- 5.85 There is unlikely to be demand from the MNOs or new entrants on this basis. National coverage is likely to be a key issue for business cases and a regional approach may leave less attractive licences unsold.

Two or more concurrent licences

- 5.86 Two or more concurrent low power UK licences (i.e. all licensees having equal access to all the available spectrum).
- 5.87 Interference management will depend critically on the number of licensees, and will require co-ordination amongst the parties. The more licensees the more difficult co-ordination will be, particularly in business districts. The low power stipulation will however, ease the co-ordination burden.
- 5.88 There is likely to be good demand for the spectrum for innovative low power applications.

Proposal

- 5.89 Ofcom proposes to grant a small number of UK low power licences. The precise number is yet to be determined but will probably be within the range of three to six. The licences will be concurrent, i.e. they will have equal access to the entire spectrum on a shared basis: no one licence will have priority over any other. All

licensees will be required to co-ordinate with each other to avoid mutual interference. Ofcom will not have a role in this co-ordination process, other than to resolve disputes where there is use outside the terms of the licence conditions.

5.90 The licences will not contain restrictions as to service provision or technology other than the power limit. Consistent with spectrum trading and liberalisation, it should be possible for licences to be traded post award. If all licences are held by one organisation, or if all licensees agree, the terms of the licences might allow high power use to replace low power use.

5.91 Ofcom considers that this proposal is likely to offer the most appropriate course of action in light of its statutory duties, in particular its duty to secure optimal use of the radio spectrum. Ofcom considers that it should promote the interests of citizens and consumers by promoting optimal use of the spectrum, while at the same time promoting competition and innovation in mobile communications services. Ofcom has taken particular account of the following considerations in making the proposal:

- the award of a number of concurrent licences for low power use should facilitate the introduction of innovative services of the broad type considered in the NERA study and identified by a number of respondents to the previous consultation;
- at the same time, the limitation in number of these licences to 3 to 6 should ensure coordination between the licensees is manageable, and the licensed (rather than licence-exempt) status of the services should ensure that protection against harmful interference is feasible; and
- the tradability of the licences, coupled with the ability (under certain conditions) to switch to high power use, and the limited number of such licences, provide a mechanism for achieving high power use if in due course low power uses turn out not to be the most efficient use of the spectrum, for example because market circumstances have changed.

5.92 Ofcom does not consider that the other options discussed offer a superior approach. In particular Ofcom considers that the option of a single national licence is likely to be inferior in terms of the promotion of optimal spectrum use and the promotion of competition. There is no need to limit the number of licences awarded to one if low power use is economically the most beneficial. Ofcom also considers that the choice between high and low power use, and the efficient assignment of the spectrum, may be affected adversely by the disparity in market power between different potential bidders. It is a well known feature of auction design that differences in market power between bidders can affect the efficiency of auction outcomes.

5.93 Finally, in line with Ofcom's general approach to the release of spectrum described in Section 4, the award process will be an appropriately designed auction which Ofcom believes will provide an objective, non-discriminatory, proportionate and transparent process for granting the licence.

5.94 Subject to responses to this consultation, Ofcom intends to auction the spectrum in 2005/06.

Question 5.7 Is the award of a small number of concurrent UK low power licences (on the basis described) the right approach?

5.95 As indicated above, in order to allow effective co-ordination between the licensees, the number of licences has to be restricted to a small number. However, the actual number offered is to a large extent a matter of judgement. An award of three licences would facilitate easier consolidation of the licences into a single wider area high power licence, whereas an award of six licences would facilitate more low power players to enter the market. In Ofcom's judgement, more than six licences would make effective co-ordination amongst the licensees impractical.

Question 5.8 What, in your opinion is the optimum number of low power licences?

1790 – 1798 MHz

5.96 In this band of spectrum there is 8 MHz of spectrum which is potentially available for release to the market. Ofcom is not planning to release this spectrum until complex issues which arise from the existing use of the band have been resolved. These are explained below.

Background

5.97 This band is currently used by the Home Office (HO) and Scottish Executive (SE) for fixed link infrastructure to provide trunked communications for the emergency services (Police and Fire & Rescue Service). Within England, Wales and Northern Ireland management of the band resides with Ofcom (management rights having been relinquished by the HO in mid 2003). Within Scotland the band is managed by the SE (i.e. the SE control the assignment of frequencies in the band in Scotland).

5.98 In England and Wales the Police are migrating out of this frequency band onto the Airwave Service and the roll out of this network will probably mean they no longer need to use the band in the next year or so. The Fire & Rescue Service use the same fixed link infrastructure for their communications system and they are in the process of procuring a replacement digital solution. However, it is not yet clear when their use of that new solution will mean they no longer need to use this band

5.99 In Scotland we understand that the migration of police forces to Airwave is approximately a year behind that in England and Wales and it is expected that the emergency services fixed link infrastructure will be required for some time to come.

5.100 In Northern Ireland there is no emergency service use of this band.

5.101 In addition to emergency service use, the band is also assigned to professional radio microphones on a secondary basis. To date however, there are no commercially available professional radio microphones suitable for this band but the radio microphone community has expressed a clear desire to retain access to this spectrum as their access to spectrum elsewhere is being squeezed.

5.102 Also, in accordance with the UK Frequency Allocation Table, MoD operates transmitting earth stations at one or more of the following sites: Menwith Hill (Yorkshire), Oakhanger (Hampshire) and Colerne (Wiltshire) in the band 1790 – 1798 MHz. Commercial operations in this band will have to accept any interference caused by these earth stations.

Description

- 5.103 At the international level the band 1790 – 1798 MHz is allocated to the fixed and mobile services.
- 5.104 Within Europe the band 1785 – 1800 MHz has been harmonised for use by professional radio microphones under CEPT Recommendation 70-03 for about seven years. Additionally, it has recently been agreed to add a licence exempt harmonised allocation for wireless audio applications under CEPT Recommendation 70-03 in the band 1795 – 1800 MHz. In the UK management of professional radio microphone use falls to the JFMG Ltd and within the band 1790 - 1798 MHz this is on a secondary (non protected, non interference) basis and is subject to co-ordination with the HO/SE links. With the introduction of licence exempt audio applications in the 1795 – 1800 MHz band it is intended that radio microphone use in this band will also become licence exempt through amendment of the Licence Exemption Regulations.
- 5.105 Being unpaired this band it is most suitable to applications based on TDD technology. There may also be options to use FDD technologies using other unpaired spectrum that may become available at a similar time (e.g. see proposals for the 2010 – 2025 MHz and 2290 – 2302 MHz bands below).

Releasing the spectrum

- 5.106 The current emergency service use of the band uses rather old, outdated analogue technology. It is geographically patchy with large areas of the country having no fixed links and other areas having very few. The current use is not spectrum efficient but the emergency service use, though in decline, is extremely important and whilst the links are in use it is vital that they are protected from interference.
- 5.107 This band sits in a part of the spectrum that is ideal for mobile applications. It is very close to existing second and third generation mobile spectrum and is suitable for many fixed and mobile uses such as WiMAX (IEEE802.16) and Mobile Broadband (IEEE802.20).
- 5.108 Ofcom has been approached by a number of organisations who wish to introduce mobile broadband services. We have conducted compatibility and sharing studies based on specific proposals for new technologies and have concluded that limited sharing of the band between the existing fixed link infrastructure and potential new mobile broadband services is possible provided certain geographical restrictions are imposed.

Proposal

- 5.109 It is clear that the existing emergency services use of the band in England, Scotland and Wales must be protected from interference from any other users in the band. However, with declining emergency service use it is not a realistic option for the band to remain dedicated to this use for an indefinite period. Accordingly, Ofcom believes that this spectrum should be released at some point.
- 5.110 In order to achieve that objective, Ofcom will:

- Work to agree a migration plan with the existing users.
- When that plan is clear, Ofcom will publish a further document setting out when and how the spectrum will be released to new services.

5.111 Ofcom believes that it should be possible to resolve the issues relating to emergency use to allow an auction for the spectrum to be held during 2007/8.

5.112 Recognising that there may be commercial incentives to deploying all-Ireland wireless networks, Ofcom has raised the possibility with ComReg, the Irish regulator, of jointly awarding spectrum in this band for use in the Republic of Ireland and Northern Ireland. The legal and regulatory issues are currently being explored.

Question 5.9 Do you believe the release of this band is a priority?

2010 – 2025 MHz

5.113 This band of spectrum is currently set aside for use on a licence exempt basis for self-provided self-co-ordinating IMT 2000 systems. However, as explained below the band remains unused. Ofcom is therefore proposing to licence use in this band and award those licences through an auction. It seeks to do this in a technology neutral way. So whilst the IMT-2000 spectrum mask is retained, Ofcom would not be prescriptive in the licences about the use of the spectrum. However, the achievement of these objectives is dependent upon changes in the EU regulation of the band. This is explained fully below. Ofcom hopes that this can be achieved next year so it will be able release the spectrum in 2005/6 probably towards the end of that financial year.

Background

5.114 The 2010 – 2025 MHz band forms part of the ‘core’ 3G bands identified by the World Administrative Radio Conference in 1992 (WARC-92) on a worldwide basis for use by administrations wishing to implement IMT-2000.

5.115 The UMTS Decision and the associated ERC Decisions (97)07, (00)01 and (99)25 provide the framework for the introduction of 3G systems in Europe. Decision (99)25 details the harmonised spectrum scheme for IMT-2000 and identifies the 2010 – 2025 MHz band for IMT-2000 TDD systems with the 2010 – 2020 MHz portion for self-provided, self-coordinating use.

5.116 At the time of the 3G Auction in the UK in 2000, the 3G auction information memorandum¹⁰ (IM) anticipated that the whole 2010 to 2025 MHz band would be set aside for licence-exempt use (or possibly for use under a light licensing regime) by short-range, low-power applications operating in self-coordinating mode. However, the IM also stated that this spectrum would not be made available in the 3G auction, but that,

“...if little or no demand develops for the spectrum set aside for licence-exempt use, it may be auctioned in due course”.

5.117 No IMT-2000 TDD equipment capable of operating in a self-provided, self-coordinating mode has been developed and the band has remained unused. As a consequence, towards the end of 2003, the RA issued a consultation that sought

¹⁰ Published on 1 November 1999 in preparation for the 3G Auction in April 2000; available at www.spectrumbauctions.gov.uk/3gindex.htm.

views on future use of the band. The consultation closed on 6 December 2003 and 13 responses were received¹¹.

5.118 It is clear from the responses to the RA consultation that there is little prospect of self-provided, self-co-ordinating IMT-2000 TDD equipment capable of exploiting the spectrum for its designated use becoming available in the foreseeable future. There were mixed views on what alternative use should be made of the spectrum but it was clear that a number of respondents felt that alternative uses based on the IMT-2000 TDD spectrum mask were viable (rather than sticking rigidly to IMT-2000 technology).

5.119 In June 2004 Ofcom presented a paper to the Radio Spectrum Committee (RSC) highlighting the lack of use and the UK's view that the self provided self co-ordinating designation should be removed and that spectrum should be auctioned for licensed use on a technology neutral basis but subject to compliance with the IMT-2000 TDD spectrum mask.

5.120 Following the RSC meeting in June, the European Commission issued a questionnaire to Member States asking a number of questions about current and potential future use of the band. For the September RSC meeting the Commission presented a paper analysing the results of the questionnaire and making proposals on the way forward.

5.121 The Commission's suggestion was as follows:

“Based on the responses to the questionnaire a possibility would be to inform the public about the intention to change the designation of the band 2010-2020 MHz (currently envisaged - but not used - for self-provided applications) to licensed use. ECC could be requested to review the relevant parts of the ERC Decision (ERC/DEC(99)25).

Noting that Member States attach quite high importance to the preservation of harmonisation in this band and that this is also in line with the previous UMTS Decision (99/128/EC¹² it seems reasonable to apply the TDD channelling arrangement as given in the current version of the ERC Decision. Flexibility and technology neutrality could be realised in the sense that any technology that can apply the given channelling arrangement within the band (i.e. same level of interference protection to adjacent spectrum and no constraints on the deployment of IMT-2000) could be implemented through national licensing schemes.”

5.122 The Commission intend to send a liaison communication to the ECC highlighting their suggestion and asking for further work on the band to be carried out. It is anticipated that ECC PT1 will further investigate the current situation in the band and develop recommendations on revision of parts of ERC Decision (99)25. It is expected that this issue will remain on the RSC agenda until discussions in ECC are complete (probably by mid 2005).

¹¹ http://www.ofcom.org.uk/legacy_regulators/ra/3g_2010_2025_consultation/

¹² Although the UMTS Decision has expired on 22 January 2003, it has resulted in a harmonised use of the 2 GHz band through the Mandates issued to ERC and the resulting ERC Decisions, including ERC/DEC(99)25, which has been implemented in the Member States.

Description

5.123 The 2010 to 2025 MHz band is already identified at the International and European level for potential use for 3G services (see Section 7).

5.124 As well as being suitable for 3G use based on IMT-2000 technologies, the band is also suitable for many other fixed and mobile uses such as WiMAX (IEEE802.16) and Mobile Broadband (IEEE 802.20). Technically there is no reason why future use of this band should be restricted to IMT-2000 technologies.

5.125 As part of the recent National Autonomy Study, an analysis of use of the 2010 – 2025 MHz band for portable wireless digital subscriber line (DSL) use was carried out. This indicated that if cross border co-ordination agreements are respected in terms of spectrum mask and power levels on the territory of neighbouring administrations, then portable wireless DSL use would be viable in the majority of mainland UK. However, coverage in the South East might be reduced over an area of up to 41,000 km² when self provided IMT-2000 TDD systems are deployed in neighbouring countries (coverage in Northern Ireland would also be significantly constrained). The effects, however, could be mitigated, for instance through the use of sectorised sites (pointing away from the border).

5.126 Being un-paired, the band is obviously suitable for TDD based equipment and has already been designated as such (see ERC Decision (99)25). However, it might be possible for users to create their own paired spectrum if other suitable bands were to be made available at a similar time, in which case FDD solutions could also be considered. One possibility is that a pairing with the 2290 – 2302 MHz band could be viable.

Options assessment

5.127 On the assumption that the current European harmonisation measures applying to the band will be amended as necessary, Ofcom has considered a number of options for the award of this spectrum as follows:

- keep the current designation for licence exempt IMT-2000 TDD systems
- auction multiple licences split by frequency (e.g. three 5 MHz licences or one 5 MHz and one 10 MHz licences)
- auction the spectrum on a regional or UK basis
- auction the spectrum on a technology neutral or technology specific basis

Maintain designation for licence exempt IMT-2000 TDD systems

5.128 In the face of the overwhelming lack of demand, Ofcom does not consider it viable to maintain the self provided self co-ordinating IMT-2000 TDD designation. It therefore believes that a licensed approach offers the most appropriate way forward.

Multiple licences split by frequency

5.129 This option could restrict the flexibility of licensees to deal with adjacent band compatibility issues and might lead to wasted spectrum. Also, a single licence of 5 MHz may not provide sufficient bandwidth for a licensee to realistically offer a full range of IMT-2000 or mobile WiMAX services for instance. However, offering the spectrum as three 5 MHz blocks but allowing organisations the opportunity to combine blocks in the award process may facilitate the market in achieving maximum economic benefit.

Regional or UK award

5.130 Offering regional licences would require the establishment of boundaries between the regions and require operators on different sides of the boundaries to co-ordinate with each other to avoid interference. This will put constraints on deployment near the boundary and is very likely to waste spectrum. Offering the spectrum as a UK licence or licences does not preclude market mechanisms from subsequently achieving a regionally based usage scheme if this is more economically beneficial.

Technology specific or neutral

5.131 As already indicated, Ofcom believes that as a matter of principle spectrum should be offered with as few technology constraints as possible as this is likely to result in the most economic value being derived from the spectrum. However, we do recognise that for planning purposes, we have to make certain assumptions about how the spectrum is most likely to be used. The 2010 – 2025 MHz band has already been designated as IMT-2000 TDD spectrum and may be used for such across Europe. It seems sensible therefore to use IMT-2000 TDD as the basis for channelisation and adjacent band compatibility purposes but to allow the use of any technology provided it is compatible with these.

Proposal

5.132 The band is subject to a number of international rules and agreements, limiting its potential use for other services. As indicated above work is ongoing within Europe to change its designation for self provided self co-ordinating applications and on the degree to which administrations will have flexibility to allow technologies outside the IMT-2000 family. We expect clarity on the future European framework to for this band emerge in 2005.

5.133 However, subject to satisfactory resolution of the European constraints, it is Ofcom's intention to offer the spectrum as one or more UK licences with the minimum of constraints, necessary to keep any the risk of interference at an acceptable level. Services and technology would not be constrained (subject to compliance with the IMT-2000 spectrum masks) and the licences would be tradable.

5.134 Ofcom believes that this proposal is consistent with the need to secure the optimal use for wireless telegraphy of radio spectrum. Granting a UK licence or licences is likely to lead to the most efficient use of the available spectrum. Licensees would not be constrained, as would be the case if small area or regional licences were awarded, by the need to co-ordinate with neighbours, which might sterilise the use of spectrum at regional borders. With a UK licence or licences licensees would also have more freedom to decide the most advantageous roll-out of services.

5.135 In line with Ofcom's general approach to the release of spectrum described in Section 4, it believes that the auction of the available spectrum in this band should ensure that it is assigned to the operator or operators who have identified the most valuable use for the spectrum and who are most likely to make the most efficient use of it.

5.136 There are a number of potential uses for the spectrum. Ofcom has to take into account the desirability of exercising its functions in a technology neutral manner; to have regard to all existing and potential demand for the spectrum and to facilitate the development of innovative services. Making licences available with the minimum of constraints, necessary to keep the risk of interference at an acceptable

level and abide by international obligations would be consistent with this. It would allow licensees to provide the most attractive services for potential customers and the opportunity to develop innovative services. Awarding this spectrum with the minimum of constraints could also reduce entry barriers associated with access to spectrum and so promote competition with existing service providers.

- 5.137 Ofcom is considering how the European spectrum framework for the band may impact on its proposal. It will need to take into account its duty to promote the European internal market alongside its other duties which require it to avoid unnecessary restrictions in the licences it grants which limit the potential uses of the spectrum.
- 5.138 Ofcom will be undertaking further work to determine the most appropriate way to award this spectrum. With the assistance of external consultants, it will analyse the business potential of the band and the technologies that might be employed. This analysis will inform both the spectrum packaging, licence conditions and award process and will help ensure that Ofcom's detailed subsequent proposals for the auction and the licence product are those most likely to meet its statutory duties and other considerations.

Question 5.10 Is a technology neutral UK licence or licences the right approach?

- 5.139 Subject to the outcome of the market study and responses to this consultation Ofcom intends to auction the 2010 - 2025 MHz band in 2005/06, with the intention that the auction should be technology neutral, if allowed by the European spectrum framework for the band. However, for cross-border co-ordination and adjacent channel compatibility purposes, IMT-2000 spectrum masks should be respected by any alternative technology.
- 5.140 To facilitate the possibility for users to create their own paired spectrum and so increase the likelihood that optimal use of this band is secured, Ofcom is considering the award for 2010 – 2025 MHz band at the same time as the award of the 2290 – 2302 MHz band. It does not envisage a single auction for the bands but it may be possible to hold two auctions at the same time perhaps allowing bidders to make bids in one auction conditional upon a certain outcome in the other auction.

Question 5.11 Do you think it useful to run the awards for 2010 – 2025 MHz and 2290 – 2302 MHz bands at the same time to facilitate the option of creating potential FDD pairings? How important do you think this is, compared to say the risk of extra complexity?

Question 5.12 Do you have any comments on how the auctions might be linked?

2290 - 2302 MHz

- 5.141 This band represents new spectrum most of which has been recently released by MoD. As set out below Ofcom plans to release this band by means of an auction but believes there may be value to linking the release to the 2010 – 2025 MHz band and therefore the timing for release is dependent upon that band. This means that the award is likely to be in 2005/06.

Background

- 5.142 Historically this band was under MoD management however, following a review of military use the band has now become available for re-assignment. The band is essentially vacant and unencumbered. At the international level the band 2290 – 2300 MHz is allocated to fixed, mobile except aeronautical mobile and space research (deep space)(space-to-earth), and the band 2300 – 2302 MHz is allocated to fixed and mobile with secondary allocations to Amateur and Radiolocation. These latter secondary allocations are not applicable in the UK.
- 5.143 There are no European harmonisation constraints on the band and Ofcom considers it suitable for both fixed and mobile uses such as IMT-2000, WiMAX (IEEE 802.16), Mobile Broadband (IEEE 802.20) and other proprietary specifications.

Description

- 5.144 Being un-paired, the band is obviously suitable for TDD based equipment. However, it might be possible for users to create their own paired spectrum if other suitable bands were to be made available at a similar time, in which case FDD solutions could also be considered. One possibility is that a pairing with the 2010 – 2025 MHz band could be viable.

Options assessment

- 5.145 Ofcom has considered a number of options for the award of this spectrum as follows:

- auction multiple licences split by frequency
- auction the spectrum on a regional or UK basis
- auction the spectrum on a technology neutral or technology specific basis

Multiple licences split by frequency

- 5.146 This option could restrict the flexibility of licensees to deal with adjacent band compatibility issues and could lead to wasted spectrum. Also, a single licence of significantly less than 12 MHz may not provide sufficient bandwidth for a licensee realistically to offer a full range of fixed or mobile broadband services. However, offering the spectrum in, perhaps, two blocks but allowing organisations the opportunity to combine blocks in the award process may facilitate the market in achieving maximum economic benefit.

Regional or UK award

- 5.147 Offering regional licences would require the establishment of boundaries between the regions and require operators on different sides of the boundaries to co-ordinate with each other to avoid interference. This will put constraints on deployment near the boundary and is very likely to waste spectrum. Offering the spectrum as a UK licence or licences does not preclude market mechanisms from subsequently achieving a regionally based usage scheme if this is more economically beneficial.

Technology specific or neutral

- 5.148 As already indicated, Ofcom believes that in general spectrum should be offered with as few technology constraints as possible as this is likely to result in the most economic value being derived from the spectrum. However, we do recognise that

for planning purposes, we have to make certain assumptions about how the spectrum is most likely to be used.

- 5.149 Ofcom favours a licensing arrangement for this band that contains the minimum of technology constraints. The spectrum should be open to any fixed or mobile technology that meets the band edge spectrum mask specified to protect adjacent spectrum users.

Proposal

- 5.150 Ofcom's proposal is to offer the spectrum packages as one or more UK licences that would have the minimum of constraints, necessary to keep any risk of interference at an acceptable level, services and technology would not be constrained and the licences would be tradable.
- 5.151 Ofcom believes that this proposal is consistent with the need to secure the optimal use for wireless telegraphy of radio spectrum. Granting a UK licence or licences is likely to lead to the most efficient use of the available spectrum. The licensees would not be constrained, as they would be if small area or regional licences were awarded, by the need to co-ordinate with its neighbours, which might sterilise the use of spectrum at regional borders. With a UK licence or licences the licensees would also have more freedom to decide the most advantageous roll-out of services.
- 5.152 In line with Ofcom's general approach to the release of spectrum described in Section 4, it believes that the auction of the available spectrum in this band should ensure that it is assigned to the operator or operators who have identified the most valuable use for the spectrum and who are most likely to make the most efficient use of it.
- 5.153 There are a number of potential uses for the spectrum. Ofcom has to take into account the desirability of exercising its functions in a technology neutral manner; to have regard to all existing and potential demand for the spectrum and to facilitate the development of innovative services. Making the licences available with the minimum of constraints necessary to keep the risk of interference at an acceptable level would be consistent with this. It would allow the licensees to provide the most attractive services for potential customers and the opportunity to develop innovative services. Awarding this spectrum with the minimum of constraints could also reduce entry barriers associated with access to spectrum and so promote competition with existing service providers.
- 5.154 Ofcom will be undertaking further work to determine the most appropriate way to award this spectrum. With the assistance of external consultants, it will analyse the business potential of the band and the technologies that might be employed. This analysis will inform the spectrum packaging, licence conditions and award process and will help ensure that Ofcom's detailed subsequent proposals for the auction and the licence are those most likely to meet its statutory duties and other considerations.

Question 5.13 Is a technology neutral UK licence or licences the right approach?

- 5.155 Subject to the outcome of the market study and responses to this consultation Ofcom intends to auction the 2290 - 2302 MHz band in 2005/06.

5.156 To facilitate the possibility for users to create their own paired spectrum and so increase the likelihood that optimal use of this band is secured, Ofcom is considering the award for 2010 – 2025 MHz band at the same time as the award of the 2290 – 2302 MHz band. It does not envisage a single auction for the bands but it may be possible to hold two auctions at the same time perhaps allowing bidders to make bids in one auction conditional upon a certain outcome in the other auction.

Question 5.14 Do you think it useful to run the awards for 2010 – 2025 MHz and 2290 – 2302 MHz bands at the same time to facilitate the option of creating potential FDD pairings? How important do you think this is, compared to say the risk of extra complexity?

Question 5.15 Do you have any comments on how the auctions might be linked?

2302 – 2310 MHz

5.157 This band is the other leg of the 1790 – 1798 MHz band discussed above. In this band there is 8 MHz of spectrum which is potentially available for release to the market. The issues which arise from the existing use of this band are similar to those discussed in relation to 1790 – 1798 MHz. Ofcom will consider releasing this spectrum when these issues have been resolved. It should be noted that Ofcom do not plan to maintain any linkage between the 1790 – 1798 MHz band and the 2302 – 2310 MHz band and any awards of spectrum in these bands are likely to be carried out separately.

2500 – 2690 MHz

Background

5.158 The 2500 – 2690 MHz band is a very significant piece of spectrum. It amounts to 190MHz of spectrum which could be used for mobile services. In contrast, the original 3G auction covered only 140 MHz. The only comparable amount of spectrum that might become available in the next decade is that which may be released by the switchover to digital television broadcasting, but there is uncertainty over the timing for this and the amount which may be released. Therefore, securing the right approach to the release of this band is crucial.

5.159 This spectrum was identified at the World Radio Conference in 2000 (WRC-2000) for use by administrations wishing to implement IMT-2000. At the time it was anticipated that additional 3G spectrum would be needed over and above that already auctioned to the UK 3G operators in 2000 some time in the future.

5.160 Since its identification in 2000 the European Commission has issued two mandates (Mandates 4 and 5) to CEPT dealing with this spectrum. In response to Mandate 4, CEPT designated the band for use by UMTS/IMT-2000 specifying that it should be made available by 1 January 2008 (see ECC Decision (02)06). Mandate 4 was issued by the European Commission pursuant to the UMTS Decision 128/199/EC. The follow-on mandate, Mandate 5, was issued in August 2003 under the Radio Spectrum Decision 676/2002/EC and asked CEPT to develop harmonised spectrum arrangements of the band in Europe.

5.161 In response to Mandate 5, CEPT has been developing a Report and Decision on detailed spectrum arrangements and a common European band plan. At the time of publication of this consultation document, the final draft of the Decision is going

through the approval stages within CEPT. It is expected that the ECC Decision will be followed by a Commission Decision which will be binding on Member States.

Description

5.162 Currently in the UK, the band is used for broadcasting video links (ENG OB). In 2003 the RA gave notice to these users to vacate the band by the 31 December 2006 and they are on track to do so. There are no other incumbent users.

5.163 As is indicated above, the 2500-2690 MHz band is designated for use by administrations wishing to implement IMT-2000. However, it is also suitable for many other fixed and mobile uses such as WiMAX (IEEE 802.16) and Mobile Broadband (IEEE 802.20). Technically there is no reason why future use of this band should be restricted to IMT-2000 technologies.

5.164 The harmonised spectrum arrangements proposed in the draft ECC Decision developed under Mandate 5 are as follows:

- The frequency band 2500 – 2570 MHz is paired with 2620 – 2690 MHz for FDD operation with the mobile transmit within the lower band and base transmit within the upper band.
- Administrations may assign the frequency band 2570 – 2620 MHz either for TDD or for FDD downlink (external). Any guard bands required to ensure adjacent band compatibility at the 2570 MHz and 2620 MHz boundaries will be decided on a national basis and taken within the band 2570 – 2620 MHz.
- Assigned blocks shall be in multiples of 5.0 MHz.
- The upper and lower frequency edges of FDD uplink and downlink blocks are specified in Figure 2.
- For 5 MHz UTRA FDD, the block edge frequency is defined with an offset of 2.5 MHz from the nearest carrier centre frequency.
- For other IMT-2000 radio interface, the block edge is to be defined on a case by case basis depending on receiver and transmitter characteristics of the radio interface in adjacent channels.

Figure 2. Upper and lower frequency edges of FDD spectrum in 2500 – 2690 MHz

ALTERNATIVE 1: IMT-2000/UMTS CHANNELLING ARRANGEMENTS BLOCKS IN THE BAND 2500 - 2690 MHz

2500 MHz	2505 MHz	2510 MHz	2515 MHz	2520 MHz	2525 MHz	2530 MHz	2535 MHz	2540 MHz	2545 MHz	2550 MHz	2555 MHz	2560 MHz	2565 MHz	2570 MHz	2575 MHz	2580 MHz	2585 MHz	2590 MHz	2595 MHz	2600 MHz	2605 MHz	2610 MHz	2615 MHz	2620 MHz	2625 MHz	2630 MHz	2635 MHz	2640 MHz	2645 MHz	2650 MHz	2655 MHz	2660 MHz	2665 MHz	2670 MHz	2675 MHz	2680 MHz	2685 MHz	2690 MHz
UL 01	UL 02	UL 03	UL 04	UL 05	UL 06	UL 07	UL 08	UL 09	UL 10	UL 11	UL 12	UL 13	UL 14	TDD*								DL 01	DL 02	DL 03	DL 04	DL 05	DL 06	DL 07	DL 08	DL 09	DL 10	DL 11	DL 12	DL 13	DL 14			
FDD Uplink Blocks																						FDD Downlink Blocks																

*Any guard bands required to ensure adjacent band compatibility at 2570 MHz and 2620 MHz boundaries will be decided on a national basis and taken within the band 2570 – 2620 MHz.

ALTERNATIVE 2: IMT-2000/UMTS CHANNELLING ARRANGEMENTS BLOCKS IN THE BAND 2500 - 2690 MHz

2500 MHz	2505 MHz	2510 MHz	2515 MHz	2520 MHz	2525 MHz	2530 MHz	2535 MHz	2540 MHz	2545 MHz	2550 MHz	2555 MHz	2560 MHz	2565 MHz	2570 MHz	2575 MHz	2580 MHz	2585 MHz	2590 MHz	2595 MHz	2600 MHz	2605 MHz	2610 MHz	2615 MHz	2620 MHz	2625 MHz	2630 MHz	2635 MHz	2640 MHz	2645 MHz	2650 MHz	2655 MHz	2660 MHz	2665 MHz	2670 MHz	2675 MHz	2680 MHz	2685 MHz	2690 MHz
UL 01	UL 02	UL 03	UL 04	UL 05	UL 06	UL 07	UL 08	UL 09	UL 10	UL 11	UL 12	UL 13	UL 14	FDD Downlink (External)*								DL 01	DL 02	DL 03	DL 04	DL 05	DL 06	DL 07	DL 08	DL 09	DL 10	DL 11	DL 12	DL 13	DL 14			
FDD Uplink Blocks																						FDD Downlink Blocks																

*Any guard bands required to ensure adjacent band compatibility at 2570 MHz and 2620 MHz boundaries will be decided on a national basis and taken within the band 2570 – 2620 MHz.

5.165 At the moment, there is a debate within in Europe relating to precisely what degree of flexibility should be afforded to administrations to allow technologies other than those within the IMT-2000 family to use the 2500 – 2690 MHz band. As it is currently written, the draft ECC Decision does not give the flexibility that Ofcom would like. However, we are currently working within Europe to make the draft ECC Decision as flexible as possible.

5.166 Ofcom is of the view that harmonised use of the band must ensure that spectrum is available for IMT-2000/UMTS systems while allowing maximum flexibility to adapt to changing circumstances. The draft ECC Decision should not preclude the possibility of accommodating technologies other than those within the IMT-2000 family provided any alternative technologies deployed respect the spectrum mask required by the European harmonised approach.

5.167 The draft ECC Decision is scheduled to be agreed in March 2005 at which time we expect the European Commission to bring forward their own proposals to the RSC to translate the ECC Decision into a binding European Union measure.

5.168 A date of mid 2006 is the earliest realistic date that the spectrum can be auctioned. Clarity on the technology options available for the band needs to be established before a detailed auction plan and information memorandum can be developed.

Options assessment

5.169 Ofcom has considered three options regarding the award of this spectrum. These are as follows:

- anticipate the EU harmonisation measures and hold an overlay auction as soon as possible, making the band available immediately for any use at all (subject to remaining incumbents' rights).
- wait until the position on any binding EU harmonisation measures are clear (we anticipate that we may get this clarity by mid 2005) and award the spectrum by auction in 2006/7 for use from 1/1/2007 on as flexible a basis as allowed by such binding measures.

- wait until there is a clear demand for additional spectrum from the incumbent 3G MNOs before auctioning the spectrum, which is not likely to lead to an auction before 2007/8 or later.

Anticipate any EU harmonisation measures and auction as soon as possible

5.170 The risks of an early award are that the EU harmonisation measures may require a change in the technical characteristics of the licences awarded. It is unlikely that the current MNOs' 3G networks will be fully mature before mid 2006: they are likely to be in the early stages of managing the transition of their customer base to 3G and balancing 2G and 3G services. It is arguable that it would not be efficient to auction the band earlier than mid 2006 as a true market valuation of the spectrum could not be made until likely demand is better established.

5.171 This is a very major auction indeed and will require lengthy and careful preparation. The advantage of an early auction therefore seems small compared to the risks. Furthermore, Ofcom is conscious of its legal obligations not to frustrate European harmonisation and the internal market.

Auction in 2006/7

5.172 There is some reason to believe that the European Commission's views are similar to Ofcom's and any binding harmonisation measures they might propose would allow Member States a degree of freedom to deploy non IMT-2000 equipment provided they respect the IMT-2000 spectrum mask. However, there is a significant risk that measures put in place at the European level could restrict Ofcom's freedom to offer the spectrum on a flexible basis. It is therefore sensible to wait until there is complete clarity on any binding harmonisation measures before proceeding with an award.

Wait until there is a clear demand from the incumbent 3G MNO's before auctioning

5.173 If we believe that the most likely use of this spectrum is for expansion of the existing 3G MNO's services there is little benefit to be gained from an earlier award. However, the band may be attractive to new entrants possibly using alternative technologies to IMT-2000. Delaying the award would prevent the market from determining whether such use is optimal.

Proposal

5.174 Ofcom is proposing to auction the 2500 – 2690 MHz band in 2006/7 with the intention that the auction to be technology neutral but respecting the IMT-2000 spectrum mask developed for the band, if allowed by any binding EU harmonisation measures. This auction timetable would comply with the European timetable of making the band available by 1 January 2008.

Question 5.16 Is a technology neutral award the right approach for the award of 2500 – 2690 MHz?

Question 5.17 Do you consider an auction in 2006/7 appropriate?

5.175 In the 3G auction held in 2000 one of the five licences was expressly reserved for a new entrant mobile operator in order to promote additional competition in the market for 3G services. Ofcom considers that the case for an explicit intervention of this kind is likely to be weaker in relation to the award process for the 2500MHz – 2690 MHz given that there are now five mobile network operators in the UK, and

given the finding that there is insufficient evidence of single or collective dominance in the most recent review of the market for mobile access and call origination (mobile outgoing services). An intervention of this kind – reserving spectrum expressly for a new entrant – would also be in tension with Ofcom’s general direction towards a more market based and less interventionist approach to spectrum management, and Ofcom’s decision for the time being to rely on general powers under competition and other law to address any competition issues raised by spectrum trading, rather than devise a new ex ante competition regime.

5.176 Ofcom has not, however, examined the matter in depth and would be interested in respondents’ views on this matter. The question of encouraging new entry via the auction design may still be highly relevant to maximising the efficiency of the assignment process and of spectrum use, but the reservation of a licence for a new entrant may not be the appropriate response to this.

Question 5.18 Do you have any views on the relevance of encouraging new entry through the auction design, and if so how this might be effected?

5.177 The award process will have to be designed carefully around the European band plan. However Ofcom eventually decides to package the spectrum on offer, we will respect the European band plan (i.e. the 2 x 70 MHz paired spectrum with 50 MHz unpaired and the 5 MHz minimum block size). There are a number of possibilities including:

- a number of specific licence packages of a predetermined size. It is likely that we would want separate packages for the paired and unpaired blocks but combined packages could be considered if that seemed appropriate at the time. Also packages may all be of equal size (say 2 x 10 MHz for FDD and 10 MHz for TDD) or we could design packages with a range of sizes. The benefit of this approach is that it is clear from the outset what spectrum is on offer. The downside is that potential bidders are prevented from bidding for exactly the amount of spectrum they need unless this happens to coincide with one of Ofcom’s pre-determined packages – though of course this could be adjusted through subsequent trading.
- a special case of the above approach could be envisaged when packages based on the minimum block sizes are defined (i.e. fourteen 2 x 5 MHz licences in the paired spectrum and ten 5 MHz licences in the unpaired spectrum). The advantage of this approach is that bidders can bid for exactly as much or as little spectrum as they need at the time. The disadvantage is that it could lead to fragmentation with contiguous blocks being difficult to acquire – though again a subsequent trading regime should be able to sort this out.
- alternatively, instead of designing specific licence packages, we could use a combinatorial auction based around the paired and un-paired 5 MHz spectrum blocks. This has the advantage of allowing bidders to acquire as much or as little spectrum as they need at the time but avoiding the problem of fragmentation. The disadvantage is that bidders would not know which actual blocks of spectrum they would get until after the auction was complete – this might be a real problem at the boundaries of the paired and unpaired

segments where adjacent band compatibility issues may have a significant effect on the utility and hence value of the spectrum.

Question 5.19 What do you consider is the right approach to packaging this spectrum?

Section 6

Potential spectrum awards over 3GHz

Introduction

- 6.1 The spectrum over 3 GHz that Ofcom has identified that is capable of supporting further use is in the bands 3.6-4.2 GHz, 10 GHz, 28 GHz, 32 GHz and 40 GHz. Apart from the first of these, where there are existing fixed services and fixed satellite service applications, the bands are relatively clear of incumbent use and the spectrum is vacant. It should be noted that 10 GHz is managed by MoD and its future use for civil applications is subject to agreement with them. Detailed descriptions of each band are set out in this section.
- 6.2 Almost all of the bands, notably 3.6 GHz, 10 GHz, 28 GHz and 40 GHz have been allocated in the past for fixed wireless access and there are some operators with assignments in each of the bands, apart from 40 GHz. In accordance with Ofcom's general approach licences in future will, as far as practicable and subject to protecting existing users, be awarded on a technology and service neutral basis. When existing licences in the band become tradable it will be open to licensees to submit a request to Ofcom for a licence variation to remove existing restrictions on the permitted purposes of transmission.
- 6.3 The bands 3.6 GHz and 10 GHz may be affected by the introduction of UWB. Ofcom will be consulting separately on UWB.

Links to Ofcom's broadband policy

- 6.4 One of Ofcom's current core projects, set out in its Annual Plan, is to advance broadband development. Its objective is to promote effective and sustainable competition in the broadband market and encourage the investment necessary for continued rollout and upgrading of infrastructure. Wireless technologies can play a significant role in achieving this, by extending coverage and increasing competition. In Ofcom's Strategic Review of Telecommunications Phase 2 consultation document, published on 18 November, it said that some wireless technologies may be used to provide next generation broadband access. These are likely to use high frequencies, and may use mesh architectures due to the propagation characteristics of these frequencies. Many of these technologies appear promising. Ofcom aims to ensure that operators wishing to employ wireless have access to the spectrum they need, when they need it. The approach to spectrum management set out here and in the SFR should go a long way to achieving this.
- 6.5 The spectrum already available is being used to make a significant contribution to increasing broadband coverage and take-up. The 2.4 GHz licence exempt band has been extensively used for the development of WiFi hotspots and community broadband networks. Ofcom's release of the 5.8 GHz band on a licensed basis for fixed wireless access extended the spectrum available. This band, with enhanced capabilities over 2.4 GHz, is particularly useful for those in more remote areas, as it allows transmissions over a longer path. Ofcom is looking at the possibility of supplementing this by developing the use of non-line-of-sight point-to-point links at 6 GHz, which would provide infrastructure connections to remote locations. Another important development is UK Broadband's activity in the 3.4 GHz band, under licences awarded by auction in June 2003, and in delivering broadband to the residential market. They plan to offer services elsewhere in the UK following a launch in the Thames Valley.

- 6.6 Ofcom believes that a liberalised and tradable spectrum market will help to encourage further use of wireless for extending coverage and competition in the delivery of broadband. The planned spectrum awards set out in this document will open up more spectrum for broadband: these include not only bands commonly designated for fixed wireless access covered in this section but also numerous bands below 3 GHz that have been covered in the preceding one. Ofcom's intention to release these on a service and technology neutral basis will mean that operators obtaining licences will be able to use them for delivering broadband services by mobile, nomadic or fixed applications. The spectrum already in the market place, as it becomes tradable and a candidate for change of use, will also be available to operators who see its potential for delivering broadband services.

3.6-4.2 GHz (3695-3875 MHz paired with 4015-4195 MHz)

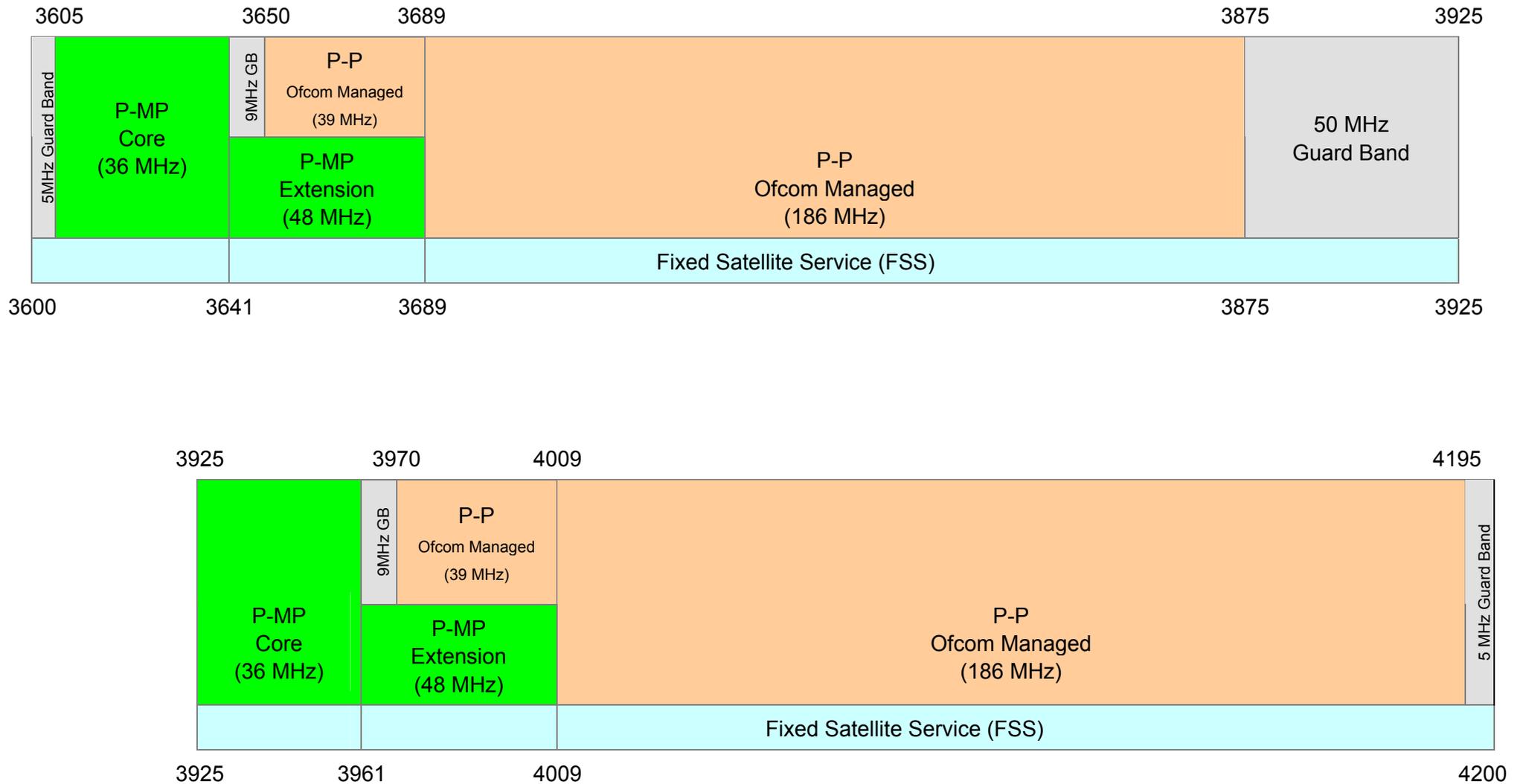
Background

- 6.7 In June 2003 the RA held an auction for 15 regional fixed wireless access (FWA) licences in the 3.4 GHz band. All licences were sold and are now held by UK Broadband. The level of interest and activity in the auction suggested that licences for FWA in this part of the spectrum were attractive. Therefore, following the auction, RA explored the possibility of opening up more spectrum for similar purposes. It identified the possibility of awarding further licences in the 3.6-4.2 GHz band. Ofcom has been considering the options for this band.

Description

- 6.8 The 3.6–4.2 GHz band is shared by fixed point-to-point (P-P), fixed satellite services (FSS) and point to multipoint (P-MP) fixed wireless access services. P-MP applications occupy 2x84 MHz, each 84 MHz leg of which is separated by 320 MHz. This allocation is made up of two parts, a core band of 2x36 MHz, which is shared with FSS, and an extension band, shared with both FSS and P-P. Frequency co-ordination is required between all three services. Appendix AP7 of the Radio Regulations is used to effect international co-ordination. Figure 3 sets out the frequency allocations in the band.

Figure 3. Existing Allocations in 3.6GHz band



Notes: (1) Guardbands shown are for the consideration of the terrestrial use only; (2) The Core band has sharing considerations with Ofcom managed satellite Earth Stations; (3) The Extended band has sharing considerations with Ofcom managed satellite Earth Stations and Ofcom managed Point to Point services; (4) The Fixed Satellite Service, in the form of Earth Stations (space to Earth) have access to the entire band

- 6.9 The band is used primarily for terrestrial fixed links and satellite earth stations. Earth stations operating in this band typically operate as receiving stations to satellites operating in the geostationary satellite orbit. In some cases, they are associated with co-sited transmit earth stations operating at 6 GHz. In other cases, the stations operate on a receive-only basis and, in general, are not registered with Ofcom, hence we do not have a record of the number or geographic disposition of the stations.
- 6.10 PIPEX Business Solutions Ltd holds a national FWA licence in the band; it is licensed to use 3605-3689/3925-4009 MHz. It is obliged to co-ordinate its base stations with Fixed Service (FS) and FSS operations in the band.
- 6.11 The band may be affected by the introduction of UWB. Ofcom will be consulting separately on UWB.

Options assessment

6.12 Ofcom has considered the following options:

- Maintaining current use of the band;
- Assigning for further terrestrial use that part of the band not already used for FWA.

Maintaining current use of the band

6.13 The use of satellite stations operating on a receive-only basis is extensive and may argue against allowing new users into the band. However co-ordination between existing and new services is possible - PIPEX already does this based on its knowledge of the use of the band. Ofcom is looking at ways of making the process as easy as possible, in order to allow effective business planning and network roll out, though this is difficult in the situation where the location of earth stations is not accurately known. Nevertheless, the possibility of co-ordinating the various services suggests that there may be scope for further terrestrial use in the band.

Allowing further use for terrestrial applications

6.14 Ofcom has explored a number of options for allowing further use of the band for FWA and similar terrestrial applications. These have involved a variety of channelling arrangements, mainly on the basis of frequency division duplex working. They also involve, as noted above, co-ordination with other users in the band. Any extended use would need to be examined carefully with existing users.

Proposal

- 6.15 Ofcom's objective is to make as much spectrum as possible available through licensing the band for new services, in accordance with its statutory duties. This is likely to involve licensing further terrestrial services in the band while taking due account of the interests of current users. Before discussing any such award in detail, it plans to consult on the need to clarify and regularise current usage of the band.
- 6.16 This could involve inviting operators to obtain RSA, a new spectrum management instrument introduced by the 2003 Act. However, no decisions have yet been taken on whether to introduce RSA in the band and there will be full and detailed consultation before any changes are made. To assist in the

future management of the band, it would be helpful to have an indication of likely future demand from satellite and terrestrial services so Ofcom can consider the options for awarding spectrum for new terrestrial services that are compatible with other users in the band.

- 6.17 Making more intensive use of the band, while protecting current users' access, should allow the more efficient use of the available spectrum. Subject to the successful outcome of Ofcom's proposed exploratory work, it plans to open up more spectrum in this band for further terrestrial services, on a technology and service neutral basis. It is too early to say exactly when an award might be possible, but it is unlikely to be before 2006/07. The approach will provide the opportunity for the development of new services and technologies that meet the demands of consumers. This will also give the operator the opportunity to compete with existing service providers and stimulate a more competitive market. Further work will be needed on the most appropriate procedure for awarding additional licences but Ofcom will aim to ensure that any process is objective, non-discriminatory, proportionate and transparent, recognising the interests of both new and existing users of the band.

Question 6.1 Do you agree that the band should be open for further terrestrial applications once Ofcom has clarified and regularised current usage in the band?

10 GHz (10.125-10.225 GHz paired with 10.475- 10.575 MHz)

Background

- 6.18 In December 2000 the RA published a consultative document 3.4 and 10 GHz: Scenarios for Spectrum Packaging and Delivery that outlined five scenarios for the packaging and delivery of licences in the 3.4 and 10 GHz bands. In February 2002 it announced that, given the industry interest in spectrum licences for the 3.4 GHz band and to avoid further delay in their award, the award processes for 3.4 and 10 GHz were to be decoupled.
- 6.19 RA also announced that, subject to the consent of the MoD, the available spectrum in the 10 GHz band should be allocated for FWA services. Consultation with industry and other interested parties on the award and packaging of the spectrum would follow later. Since publication of the 2000 consultative document, Scottish Power & Telecom (Thus) and Cable & Wireless had surrendered, respectively, their regional and national 10 GHz licences. NTL has recently surrendered the FWA licence that authorised it to operate nationally in the band. This makes a pair of 100 MHz channels in the band available for award. Ofcom has been considering the options for this band.

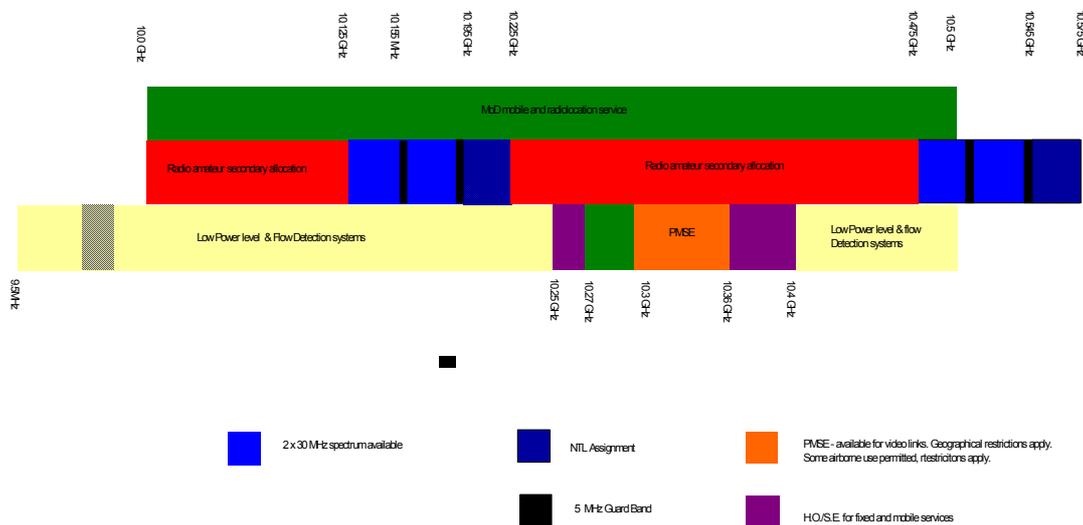
Description

- 6.20 The 10GHz band is managed by the MoD and is used for a number of military purposes. Civil use has been agreed for FWA and for Short Range Devices (low-power level and flow detection devices). There is also a secondary allocation to the Amateur radio service in the bands 10.000-10.125 GHz and 10.225-10.475 GHz bands and to the Amateur and Amateur Satellite services in the 10.475-10.500 GHz band.
- 6.21 An agreement with MoD allows FWA at 10.125-10.225 GHz paired with 10.475-10.575 GHz (a total of 2x100 MHz inclusive of guard bands). Ofcom is

exploring with MoD the arrangements that would apply to any new licensee for co-ordinating its services with military operations. It is not expected that the military use would have more than an occasional localised impact on civil use, and Ofcom intends to provide information on this before the award of further spectrum for civil use.

6.22 The short range devices in the band are low-power flow and level detection systems, which are devices used mainly for measuring the contents of containers at industrial sites such as refineries. If they comply with the requirements of the Wireless Telegraphy (Exemption) Regulations 2003 (S.I. 2003/74) (which require equipment to meet the UK Interface Requirements (IR2030) under the heading Equipment for the Detection of Movement or Alert), they do not require a licence. Tank level gauges operating outside the stated parameters in IR2030 are subject to licensing but Ofcom is considering an ECC proposal to exempt these devices from licensing. Figure 4 below sets out the current allocations in the band.

Figure 4. Existing Allocations in 10GHz band



6.23 The band may be affected by the introduction of UWB. Ofcom will be consulting separately on UWB.

Options assessment

6.24 Ofcom has considered either excluding further civil use or allocating 2 x 100 MHz in the band for civil use.

Exclude further civil use

6.25 MoD do not plan to reduce military use of the band and this will impose some constraints on civil use. However these constraints should not seriously impair the value of the band for other users. This represents an attractive opportunity for development, and optimising civil and military sharing will enhance efficient spectrum use.

Allocate for civil use

6.26 The band is suitable for a variety of uses. These include fixed point-to-point or point-to-multipoint for fixed wireless access or other services. There is an allocation for programme making, between the two blocks that have been identified for FWA, and further spectrum could be suitable for outside broadcast use, such as video links, in harmony with similar use within the rest of Europe. In line with Ofcom's approach to liberalisation of spectrum use it would award licences on a service and technology neutral basis.

Proposal

6.27 The band represents a significant amount of spectrum that offers the opportunity for development for civil use, even though it has not so far been developed successfully for commercially viable FWA services. In order to allow the greatest chance of future success Ofcom believes it should be offered to the market on a technology and service neutral basis, consistent with the need to protect military use. This will allow operators maximum flexibility to put the spectrum to its most efficient use. Ofcom proposes to award the spectrum as a single UK package, which will also maximise the opportunity for the licensee. The rights to the spectrum would be tradable from the date of award, allowing spectrum and geographic segmentation through "partial transfers". The licence would be awarded by auction, with the auction design likely to be simple and straightforward. Ofcom anticipates it should be possible to hold this auction in 2006/07.

6.28 There are a number of potential uses for the spectrum, including fixed point-to-point and point-to-multipoint and programme making. Ofcom has to take into account requirements to have regard to desirability of exercising its functions in a technology neutral manner: to have regard to all existing and potential demand for the spectrum and to facilitate the development of innovative services. Making the licence available with little or no constraint on service provision or technology would be consistent with this. It would allow the licensee to provide the most attractive services for potential customers and the opportunity to develop innovative services. Awarding this spectrum with the minimum of constraints could also reduce entry barriers associated with access to spectrum and so promote competition with existing service providers.

6.29 Granting a single UK licence is likely to lead to the most efficient use of the available spectrum. The licensee would not be constrained, as it would be if small area or regional licences were awarded, by the need to co-ordinate with its neighbours, which might sterilise the use of spectrum at regional borders. Assigning all the available spectrum in one licence would similarly obviate the need for guard bands between different users' assignments. With a national licence the licensee would also have more freedom to decide the most advantageous roll-out of services. Ofcom will require the licensee to co-ordinate its use with the MoD and a national licence will give more flexibility in reconciling roll-out plans with the need to protect military use.

6.30 In line with Ofcom's general approach to the release of spectrum described in Section 4, it believes that the auction of the available spectrum in this band should ensure that it is assigned to the operator who has identified the most valuable use for the spectrum and is most likely to make the most efficient use of it.

Question 6.2 Do you agree with the proposal to award a single UK licence on a service and technology neutral basis?

28 GHz (28.0525 to 29.4525 GHz)

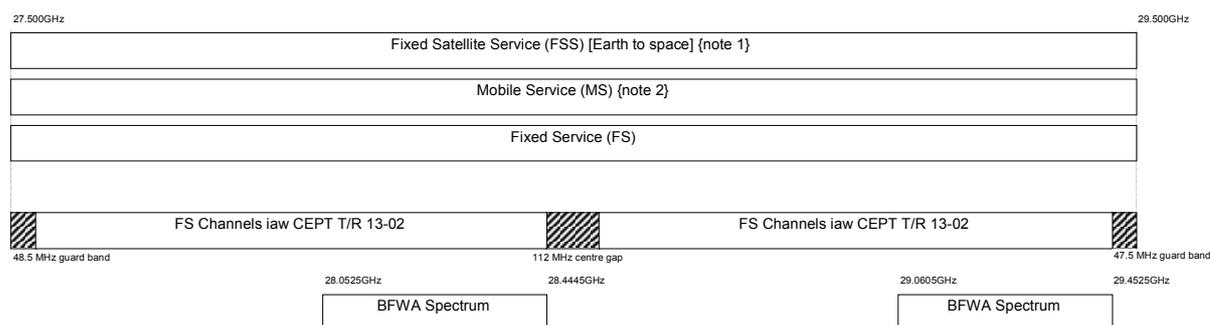
Background

- 6.31 FWA licences in the 28 GHz band were auctioned in November 2000. 42 licences were on offer (three in each of 11 English regions, Scotland, Wales and Northern Ireland) and 15 were awarded following the auction:
- three in Greater London;
 - three in Greater Manchester;
 - three in the West Midlands;
 - three in Northern Ireland; and
 - four in Yorkshire, Northern England and Scotland.
- 6.32 One of the Northern Ireland licences was subsequently surrendered.
- 6.33 The remaining 27 licences were offered in a modified procedure that opened in October 2001. The licences were open for bids - at the original reserve prices – at any time during the following twelve months. No further licences were awarded by the end of this period.
- 6.34 In November 2003 the RA sought industry views on alternatives to regional licences: offering licences on the basis of pre-determined areas (e.g. county licences), or by operators nominating areas they want, or by licensing individual base stations. Ofcom has been exploring all options for awarding the remaining spectrum in the band.
- 6.35 FWA licences in the band are for a fixed 15 year term. They are tradable, as of December 2004. This allows the transfer of rights of spectrum use or geographical coverage by way of partial transfer, without limit on divisibility, provided that original licence conditions on deployment continue to be met. The licences are already relatively neutral on technology and usage and impose no modulation, technology or antenna characteristics.

Description

- 6.36 FWA systems employ radio links to connect users' premises and telecommunications networks or to provide transmission capacity for telecommunications infrastructure. They can deliver data rates in excess of 2 Mbit/s and provide a wide range of telecommunications services, including telephony, internet access, high-speed data, and multimedia.
- 6.37 The 27.5 GHz to 29.5 GHz band is shared on a co-primary basis between the FS, FSS and the Mobile Service (MS). The Broadband Fixed Wireless Access (BFWA) spectrum has been planned in accordance with the CEPT T/R 13–02 recommended channel plan. Two frequency blocks of 392 MHz are available and are given by 28.0525 GHz to 28.4445 GHz paired with 29.0605 GHz to 29.4525 GHz. The layout of the frequency band, showing the BFWA spectrum, is given in Figure 5.

Figure 5. Frequency band for 27.5 – 29.5 GHz



Notes

- 1) The use of the band 29.1GHz to 29.5GHz [Earth to space] by the fixed satellite service is to geostationary-satellite systems and feeder links to non-geostationary-satellite systems in mobile-satellite
- 2) Currently no planned use with the UK.

6.38 The allocation of parts of the band in Europe to either the FS or FSS is detailed in ERC Decision ERC/DEC(00)09. This Decision has recently been revised due to changes at the International Telecommunication Union – World Radio Conference held in 2003. As a result additional spectrum within the 28 GHz band (27.5 – 29.5 GHz) has been earmarked for use by uncoordinated, freely deployed satellite earth stations. That spectrum adjustment does not affect the spectrum within 28 GHz that has been awarded to or identified for, BFWA. The consultation on the revised Decision closed on 23 December 2004.

BFWA Spectrum Packages

6.39 BFWA licences cover 11 English regions, Scotland, Wales and Northern Ireland with three licences per region. RA applied 28 MHz guard bands between the three licensed frequency blocks in each region. The resulting three spectrum packages are detailed below.

- Package 1: 28.0525 - 28.1645 GHz (BFWA 1) paired with 29.0605 - 29.1725 GHz (BFWA 1)
- Package 2: 28.1925 - 28.3045 GHz (BFWA 2) paired with 29.2005 - 29.3125 GHz (BFWA 2)
- Package 3: 28.3325 - 28.4445 GHz (BFWA 3) paired with 29.3405 - 29.4525 GHz (BFWA 3)

6.40 FWA licences define both (i) geographical boundaries of those parts of the UK within which licensees may deploy base stations and (ii) the technical characteristics of the base stations. Interference between assignments is managed through procedures that are based on co-ordination agreements between neighbouring licensees. The procedures specify the power flux density (pfd) levels and spatial separations that trigger when coordination is required, but the procedures do not dictate the form of the coordination agreement.

6.41 Table 6.1 below shows which licences have been allocated and which remain available for a further award.

Table 6.1 – Status of licences for 28 GHz

Region	Licence 1 (28.0525 - 28.1645 GHz paired with 29.0605 - 29.1725 GHz)	Licence 2 (28.1925 - 28.3045 GHz paired with 29.2005 - 29.3125 GHz)	Licence 3 (28.3325 - 28.4445 GHz paired with 29.3405 - 29.4525 GHz)
Greater London	Energis Local Access Ltd	Broadnet UK Ltd	Pipex UK Ltd
Greater Manchester	Your Communications Ltd	Energis Local Access Ltd	Pipex UK Ltd
West Midlands	Energis Local Access Ltd	Your Communications Ltd	Pipex UK Ltd
Home counties - west	--Available--	--Available--	--Available--
Home counties - north	--Available--	--Available--	--Available--
East Anglia	--Available--	--Available--	--Available--
East Midlands	--Available--	--Available--	--Available--
Home counties - south	--Available--	--Available--	--Available--
Yorkshire	Energis Local Access Ltd	Your Communications Ltd	--Available--
Northern England	--Available--	Your Communications Ltd	--Available--
South-west England	--Available--	--Available--	--Available--
Scotland	--Available--	Energis Local Access Ltd	--Available--
Wales	--Available--	--Available--	--Available--
Northern Ireland	Energis Local Access Ltd	Chorus Communication Ltd	--Available-- (Returned by Eircom after auction)

6.42 Licensees are at various stages of development. In particular, Your Communications Ltd has developed commercial services within the regions for which it holds licences.

Options assessment

6.43 Ofcom has looked at a number of options for releasing the spectrum still available:

- Delay or abandon further licensing;
- Exempt from licensing;
- License base stations;

- License small areas; and
- License existing regions.

Delay or abandon further licensing

6.44 Ofcom believes that this option should be rejected as it would deny an opportunity to those operators who have expressed an interest in developing services in the band and so is unlikely to secure optimal use of the radio spectrum.

Licence exempt equipment operating in the band

6.45 The significant potential for interference between operations in neighbouring channels or locations calls for licensing of individual operators, particularly where operators want to guarantee quality of service to their customers. Licensing is therefore necessary to allow the spectrum to be used more effectively and efficiently.

License base stations individually

6.46 Licensing individual base stations on a first come first served basis would allow operators to establish services in localities that they had identified as providing attractive business opportunities. However, this could involve detailed coordination to avoid interference between neighbouring operators, which would be administratively onerous. Furthermore, now spectrum trading is allowed it is possible for individual base stations to be established within a regional licensing approach. Operators with limited business plans for particular individual base stations may negotiate with regional licence holders access to spectrum at specific locations. Ofcom considers that, given the limitations on information available as to local area demand and the transaction costs involved in licensing individual base stations, it is likely to be more efficient for any such local demand to be met through the market mechanism in the environment of spectrum trading rather than through administrative intervention by Ofcom.

License small areas

6.47 Licensing areas that are substantially smaller than the existing regions would arguably be more consistent with business models for services in this band. This would be a compromise between the base station and regional licence approach that would avoid the co-ordination problems associated with the base station approach. But, as with that option, if we retain the original regional licence approach it should be possible, through spectrum trading, for use of the spectrum on a small area basis to develop if it is economically viable. Smaller coverage areas could be created by negotiation between the regional licensees and those wanting to operate within their regions.

License existing regions

6.48 Holding a regional licence gives the operator the freedom to establish services wherever it likes within the region, when it likes, without reference to Ofcom. Co-ordination issues may arise at the borders and with adjacent channel users within the region but we have agreed guidelines to enable these issues to be resolved satisfactorily between the operators concerned.

Proposal

- 6.49 Ofcom intends to award the licences for the use of the available spectrum as regional licences on the basis of the original regional borders and spectrum packaging and with a 15 year licence term. It recognises that fixed licence term of 15 years is different in approach from that set out in Section 4 as Ofcom's generally preferred approach. However, it believes that it is appropriate in this case to ensure parity with the existing licences that have been issued in this band.
- 6.50 In line with Ofcom's general approach to the release of spectrum described in Section 4, it believes that an auction would be an efficient way of awarding the licences. However, many companies have argued that the original reserve prices were a serious impediment to their bidding for licences, given the high level of investment also required for developing a network. Ofcom therefore would wish to offer the available licences at reserve prices substantially lower than those in both the 2000 and 2001 auction procedures, which ranged from £100,000 to £4 million.¹³
- 6.51 The award process would be on similar lines to the one introduced in October 2001. It will be designed to allow companies to submit their bids for licences at a time that fits in with their business plans. It will consist of two stages:

Primary bid stage

- 6.52 Ofcom plans to start the process in 2005/06. The earliest date for application will be announced at the time of the publication of the Information Memorandum. From that date any interested companies would be able to submit an application for a specific licence in a region. They would have to provide details of their company structure and a deposit with their application. The details of company structure are needed to check whether there are any associations between bidders (if more than one applies) and the deposits are a safeguard against default of payment following the auction.
- 6.53 An application in any region would trigger the start of a period of 20 business days when any other company could apply for a licence in that region. An application would constitute a bid for that licence at the relevant reserve price. Details of regional licence applications would then be posted on Ofcom's

¹³ The reserve prices for each licence in both previous auctions were as follows: region A (Greater London) £4,000,000; Region B (Greater Manchester, Merseyside and Cheshire) £3,000,000; Region C (West Midlands, Warwickshire, Staffordshire, Worcestershire Shropshire and Herefordshire) £3,000,000; Region D (Isle of Wight, Hampshire, Berkshire and Oxfordshire) £2,000,000; Region E (Essex, Hertfordshire and Buckinghamshire) £2,000,000; Region F (Suffolk, Norfolk, Bedfordshire, Cambridgeshire and Northamptonshire) £2,000,000; Region G (Derbyshire, Lincolnshire (other than the Local Authorities of North Lincolnshire and North-East Lincolnshire) , Leicestershire, Nottinghamshire and Rutland), £2,000,000; Region H (Kent, Surrey, East Sussex and West Sussex), £2,000,000; Region I (East Riding of Yorkshire, North Yorkshire, South Yorkshire, West Yorkshire and the Local Authorities of North Lincolnshire and North-East Lincolnshire), £2,000,000; Region J (Tyne and Wear, Durham, Northumberland, Cumbria and Lancashire), £1,000,000; Region K (Bristol, Devon, Cornwall, Dorset, Somerset, Wiltshire and Gloucestershire), each WT Act Licence £1,000,000; Region L (Scotland), £1,000,000; Region M (Wales), £1,000,000; Region N (Northern Ireland) £100,000.

website. At the end of that 20 day period, no further applications would be accepted for that region.

- 6.54 If there was only one application for any particular licence in a region the award process could be quickly completed. Ofcom anticipates it would be able to announce the award of licences within 10 business days from the end of the application period. Payment for the licence at the reserve price would be required soon afterwards.
- 6.55 In the event that the number of applicants was greater than the number of available licences the licensing process would move to an auction stage.

Auction stage

- 6.56 An auction would be required if either:
- The number of applications in a region was greater than the number of available licences; or
 - Two or more applicants expressed an interest in a particular licence in a region
- 6.57 Each of the regions would be licensed independently of each other so there could be a number of regional auctions spread over the duration of the award process.
- 6.58 The auction is likely to be a single round sealed bid auction. Further details will become available on Ofcom website as the process is developed and final details will be published in the Information Memorandum.
- 6.59 Licences would be issued shortly after the completion of the auction.
- 6.60 No closure date for the whole award process for the remaining spectrum would be set at the outset, although Ofcom may wish to close it at an unspecified future date, possibly before all licences have been awarded.

Conclusion

- 6.61 Ofcom believes that the proposal to award the remaining regional licences will secure the optimal use for wireless telegraphy of radio spectrum. The regions have been designed, and regional borders drawn, to minimise, as far as possible, the likely incidence of interference between neighbouring operators, so allowing them to use the available spectrum to its maximum. Similarly, in packaging the spectrum, guard bands have been included to minimise interference between operators and so maximise the use of the available licensed spectrum. Furthermore, spectrum trading would allow each region to be geographically partitioned into smaller areas to suit an operator that might want only partial coverage or may want to expand the border of a neighbouring region. A licensee could also allow temporary use of base stations through spectrum trading. In fact, trading could address the same need as the option for individual base station licensing, without Ofcom becoming involved in detailed co-ordination. Accordingly, Ofcom believes that its proposal is likely to lead to the most economically efficient outcome. It therefore also meets the requirements to have regard to efficient management and use of spectrum and to the economic and other benefits which may arise from the use of the spectrum.

- 6.62 In proposing to make the licence available with little or no constraint on service provision or technology Ofcom has taken into account a number of its statutory duties, in particular: the requirement to exercise its functions in a technology neutral manner; the need to have regard to all existing and potential demand for the spectrum; and need to facilitate the development of innovative services.
- 6.63 Ofcom has also considered its duty to promote competition, it believes that the existence of three licences in each region opens the prospect for competition between licence holders.
- 6.64 Finally, in line with Ofcom's general approach to the release of spectrum described in Section 4, it believes that the auction of the available spectrum in this band should ensure that it is assigned to the operator who has identified the most valuable use for the spectrum and is most likely to make the most efficient use of it. The auction process described above is an objective, non-discriminatory, proportionate and transparent process for granting the licences. It is also designed to impose the minimum burden on bidders where there is only limited demand for licences in a region. Ofcom believes it is proportionate and reasonable to reduce the reserve price reflecting the fact that on previous occasions the licences were not purchased at those higher prices.

Question 6.3 Do you agree with the proposal to open an award process for the remaining regional licences on the lines suggested?

32 GHz Band (31.8-33.1 GHz)

Background

- 6.65 The 32 GHz band (31.8 to 33.4 GHz) is allocated to the fixed service on a primary basis in the UK and on an international basis through the Radio Regulations and the European Common Allocation Table. The band has been planned in the UK for the introduction of fixed services in a phased manner. The first step was opening part of the band for point-to-point applications from February 2003; this is the upper third of the two sub-bands (32.319 – 32.571 GHz duplexed with 33.131 – 33.383 GHz). The remaining two-thirds were held back for future possibilities in line with one of the Cave Report's recommendations.
- 6.66 The Cave Report recommended that where licensees were currently granted tailored access to shared spectrum that was managed by the RA, such as in fixed links and certain private mobile radio bands, RA should move progressively to converting the spectrum to auctionable geographic licence blocks (see recommendation 7.8). In response the Government agreed that the concept had attractions and, in order to explore its feasibility and potential, RA intended to conduct a pilot scheme when a suitable opportunity arose, possibly in unassigned spectrum in the fixed link bands at 32 GHz.

Description

- 6.67 The 31.8-33.4 GHz band was allocated to the fixed service at WRC-97 on a provisional basis under an agenda item looking at FS allocations for high density applications in the fixed service. The discussions were highly contentious at the time due to military airborne radar interests. After further study and negotiation WRC-2000 confirmed this allocation, which is also referenced in footnote RR 5.547 (Global high density FS identification). The

issue at the time was to identify spectrum that could be designated on a global basis to cater for the future projected FS requirements, both access applications and the increasing mobile infrastructure requirements. The idea of the designation was to put a flag in the Radio Regulations to administrations/operators/manufacturers to highlight that the band could be used by such high density FS applications.

- 6.68 One of the major advantages of the 32 GHz band is that it is not shared with the FSS. ITU-R SG9 has also developed two recommendations for this band (F.1520 & F.1571) that detail the channel arrangements and the mitigation techniques with respect to sharing with air borne radars. CEPT has also developed FS channel arrangements contained in ECC Recommendation 01-02.

Options assessment

6.69 Ofcom has considered three options:

- Launch a pilot scheme for innovative proposals in line with the Cave Report;
- Auction the spectrum in conjunction with 28 GHz; and
- Auction the band in a separate award.

Pilot scheme

6.70 There have been no proposals to date from industry that could form the basis for a pilot scheme.

Auction with 28 GHz

6.71 There may be some synergy between the bands: both are fixed service bands with similar propagation characteristics, and equipment may be produced capable of operating in either, with necessary but manageable adjustments. Despite (or because of) the similarities between the two bands it is not clear that an operator would see a business case for developing both in combination. Also, packaging the two bands to make a single offering would be difficult, particularly as some 28 GHz regional licences have already been awarded.

Auction the band in a separate award

6.72 Auction the band on a service and technology neutral basis would allow the operator the flexibility to develop the spectrum in the way it judged best. There is sufficient spectrum available to award two licences of 2 x 250 MHz but it may be preferable to award a single licence of 2 x 500 MHz. The licence or licences would cover the whole UK (England, Scotland, Wales and Northern Ireland).

Proposal

6.73 Ofcom proposes to award the currently unassigned two thirds of the 32 GHz band by auction on a technology and service neutral basis. It recognises the CAA's interest in the band and will consult it before embarking on detailed work on the award. It proposes to award the spectrum either in the form of either one licence or two licences of 2 x 250 MHz covering the whole of the UK. The rights to the spectrum will be tradable from the date of award and partial transfers, allowing spectrum and geographic segmentation, would be permitted under the Wireless Telegraphy (Spectrum Trading) Regulations 2004 to the maximum extent technically possible. The award process would be similar to that

explained above for the award of remaining licences for 28 GHz. Basically this involves opening the process and then any bids received will be publicised and for a limited period, probably of four weeks, other companies may submit bids for the relevant licence. There would be competitive bidding for a licence only if other bids are submitted. Otherwise the licence will be awarded to the sole bidder. Ofcom expects to hold this award in 2006/07.

- 6.74 There are a number of potential uses for the spectrum, including fixed point-to-point and point-to-multipoint. Ofcom has to take into account requirements to exercise its functions in a technology neutral manner; to have regard to all existing and potential demand for the spectrum; and to facilitate the development of innovative services. Making the licence available with little or no constraint on service provision or technology would be consistent with this. It would allow the licensee to provide the most attractive services for potential customers and the opportunity to develop innovative services. Awarding this spectrum with the minimum of constraints could also reduce entry barriers associated with access to spectrum and so promote competition with existing service providers.
- 6.75 Granting a single UK licence is likely to lead to the most efficient use of the available spectrum, subject to adequate demand and interested bidders. The licensee would not be constrained, as it would be if small area or regional licences were awarded, by the need to co-ordinate with its neighbours, which might sterilise the use of spectrum at regional borders. Assigning all the available spectrum in one licence would similarly obviate the need for guard bands between different users' assignments. With a national licence the licensee would also have more freedom to decide the most advantageous roll-out of services.
- 6.76 In line with Ofcom's general approach to the release of spectrum described in Section 4, it believes that the auction of the available spectrum in this band should ensure that it is assigned to the operator who has identified the most valuable use for the spectrum and is most likely to make the most efficient use of it, in both commercial and spectrum management terms. The auction process described above is an objective, non-discriminatory, proportionate and transparent process for granting the licences. It is also designed to impose the minimum burden on bidders where there is only limited demand for licences in a region.

Question 6.4 Do you agree with the proposal to award one or more UK licences on a service and technology neutral basis?

Question 6.5 How many licences should be offered?

Question 6.6 Do you agree that the award process should be on the lines proposed?

40 GHz (40.5 to 43.5 GHz)

Background

- 6.77 In July 1999 RA published a consultation document *Wireless in the Information Age* seeking responses on proposals for opening the 28 GHz and 40 GHz bands for broadband fixed wireless access. Responses suggested that the 40 GHz was a band for future development – possibly in 2-3 years – for domestic customers and/or urban areas.

6.78 In September 2000 KPMG completed for RA an analysis of the potential market for 40 GHz licences. Their main conclusions were:

- The residential BFWA market did not appear to be profitable under any scenario given the current level of capital and operating costs and the low revenues associated with broadcasting customers. Only business telecoms services returned a positive internal rate of return.
- Since operators were unlikely to find a viable market from residential customers for bandwidth hungry video services, at least for the immediate future, there were questions about the timing of licence award and the way in which the massive amount of spectrum should be filtered into licensees' hands. Careful consideration of the packaging of the licences and the number and size of licence packages to make available per area would be required.
- They believed that a delay in awarding licences would allow operators to evaluate the technology and reduce perceived risk and uncertainty. The economics of services to the residential market could change as equipment costs changed over time: eventually it might become commercially feasible to identify high spending residential customers or - small office / home office (SoHo) customers who might be potential customers for operators. Residents of multi-occupied premises could also be targets as the costs of the customer equipment could then be spread over several customers.

6.79 During the summer of 2002, RA held discussions with a range of interested companies on the scope for developing the band for Multimedia Wireless Systems (MWS). In summary the main points to emerge were:

- Companies generally supported opening the band, but they thought that a market for very high bandwidth services delivered by MWS was not likely to develop before 2005. The business market for small and medium sized companies, SoHos and large corporations was likely to be the first to emerge; the residential market is seen as key but likely to emerge later;
- RA should publish a timetable for licensing the band, although some thought that 28 GHz should be fully utilised before issuing licences at 40 GHz. A government commitment to awarding licences would encourage investment in product development;
- Licences allowing commercial trials over a period of at least 5 years, with the possibility of extension, should be considered.

6.80 RA announced, in October 2002, that in the light of these discussions it did not propose to license the band within the next two years, except possibly for commercial trial licences. It would publish a timetable for full licensing of the band once it became clear that a market was emerging for very high bandwidth services. In the interim it would consider the design of an award process and the feasibility of offering commercial trial licences. The results of this work would be published in a consultation document, provisionally projected for 2003, outlining the proposed way forward.

6.81 During the course of 2004 Ofcom has explored all options for the band.

Description

6.82 The 40 GHz band covers 40.5-43.5 GHz. The ITU has allocated 40.5-42.5 GHz on a co-primary basis to broadcasting, broadcasting-satellite, fixed and fixed satellite services, and 42.5-43.5 GHz on a co-primary basis to fixed, fixed-satellite, mobile and radio astronomy services. Currently the ITU are finalising two documents that look to address the sharing criteria for the band, between terrestrial services and the radio astronomy service.

6.83 The ERC in June 1999 designated the 40 GHz band for MWS, which it defined as terrestrial multipoint systems that provide fixed wireless access to the end user for multimedia services (ECC/DEC(99)15). Such systems could deliver very high bandwidth, sufficient for a host of broadcast services as well as high capacity and high speed two-way telecommunication links which could be used for video on demand, gaming, webcasting etc.

6.84 The band 42.5-43.5 GHz is currently used in the UK by the radio astronomy service but there are no terrestrial services in it.

Options assessment

6.85 Ofcom has looked at the following options for future use of the band for terrestrial services:

- License location-specific point-to-point links;
- License various systems on request;
- License on a pioneer basis;
- Award regional licences;
- Licence exempt;
- License under a simple award process.

License location-specific point-to-point assignments

6.86 This would allow operators to request point-to-point links which Ofcom would assign using its standard fixed links assignment tool. This would be a limited use of the band, excluding its use for MWS and similar new technologies and services. There does not appear to be demand for a fixed links band in this part of the spectrum.

License various systems on request

6.87 This would facilitate the assignment of any fixed service, point-to-point, point-to-multipoint and mesh systems, on request. Assignments would be made by Ofcom using a bespoke spectrum management software tool. It would involve Ofcom in micro-management of the band, which is a task better left to the market.

Award pioneer licences

6.88 Pioneer licences may be awarded prior to a full award in order to inform the market about the commercial possibilities of broadband wireless and the robustness and maturity of the technology. These might be restricted in duration and in the geographical area which they covered. Licence terms might

be set to reflect the uncertainty of setting up networks and the inevitable technology introduction problems. However there are practical problems, including setting up an award process that is objective, transparent and non-discriminatory, determining how long pioneer rights should last and setting the balance of rights between pioneer licensees and full licensees.

Award regional licences

- 6.89 One or more licences in pre-determined regions might be awarded by auction. This would give each licence holder exclusive rights to the spectrum, probably for a limited period, which has typically been 15 years in previous auctions. The licences would be tradable from the date of award, allowing frequency and geographic segmentation.

Licence exempt equipment operating in the band

- 6.90 Propagation characteristics in the band mean that the spatial separation between neighbouring users, needed to avoid interference, is relatively small. This could make the band appropriate for licence exemption, at least in that part not shared with radio astronomy. However, operators may wish to deliver high quality services that could not be guaranteed in such an environment.

License under a simple award process

- 6.91 A close alternative to licence exemption would be a licensing process that placed minimal burdens on operators. There would be no restriction on the number of licences issued, and so there would be no requirement for them to be tradable. Licence fees might be set on an administrative cost recovery basis.

Proposal

- 6.92 Ofcom's objective in opening the band will be to encourage the development of new technologies and exploration of the market opportunity for new services. This suggests opening the band in as flexible and light-handed a way as practicable. Given the risks and uncertainties involved, but also the long term potential of the band for delivering high bandwidth services, it would also want to limit the initial allocation of spectrum. (The allocation would be in that part of the band not currently used by radio astronomy.)
- 6.93 It is proposed to allocate a pair of 250 MHz channels, which would be sufficient to allow the provision of high bandwidth services and the use of a variety of technologies. Licences will be for restricted geographic areas. Ofcom will require those using the band to notify details of their use so that it can monitor developments, which will help it to assess whether opening the band for more extensive use would be justified. It would review the position initially after five years, and, if necessary, thereafter on a regular basis. In the light of use of the band it would consider whether further spectrum should be released and the appropriate regulatory environment, for example whether exclusive geographic licences would make sense or, at the other extreme, whether there should be full licence exemption. In order to undertake this monitoring it will need to know who is operating in the band and periodically discuss progress with them. A licensing regime would allow it to do this, given that under licence exemption registration of operators is virtually impossible to enforce. Ofcom would aim to establish the licensing process by the end of 2005/06

6.94 The proposal represents the first step towards opening up spectrum that is currently unused, with the intention of providing access to the whole band when it becomes clear that operators are in a position to make productive use of it. Ofcom believes that this approach offers a way of making optimal use of the spectrum in the longer term. Making the licence available with little or no constraint on service provision or technology should allow operators to explore a variety of potential commercial opportunities that could eventually lead to new competitive services. During the initial award process there will be no restriction on the number of licences issued and licensing will be based on a straightforward application procedure. This will ensure the process is objective, non-discriminatory, proportionate and transparent.

Question 6.7 Do you agree with the proposal to license part of the 40 GHz band to encourage its use for the development of innovative services and technologies?

Question 6.8 How much of the band should be opened for this purposes and what technical conditions should be imposed?

Question 6.9 Within what timescale should this licensing process be opened, in particular is the suggestion of the end of 2005/06 appropriate?

Question 6.10 Do you agree that point to point links should be licensed in part of this band on a location specific assigned basis, in the same way the existing point to point bands are licensed. If so how much spectrum do you consider would be appropriate for this?

Section 7

Spectrum and the mobile sector

7.1 This Section provides some background to Sections 8 – 10, which discuss particular policy issues relating to 2G and 3G mobile services. This material is also relevant to the proposals for release of some bands discussed in sections 5 – 6, including 2500 – 2690 MHz. In particular it provides:

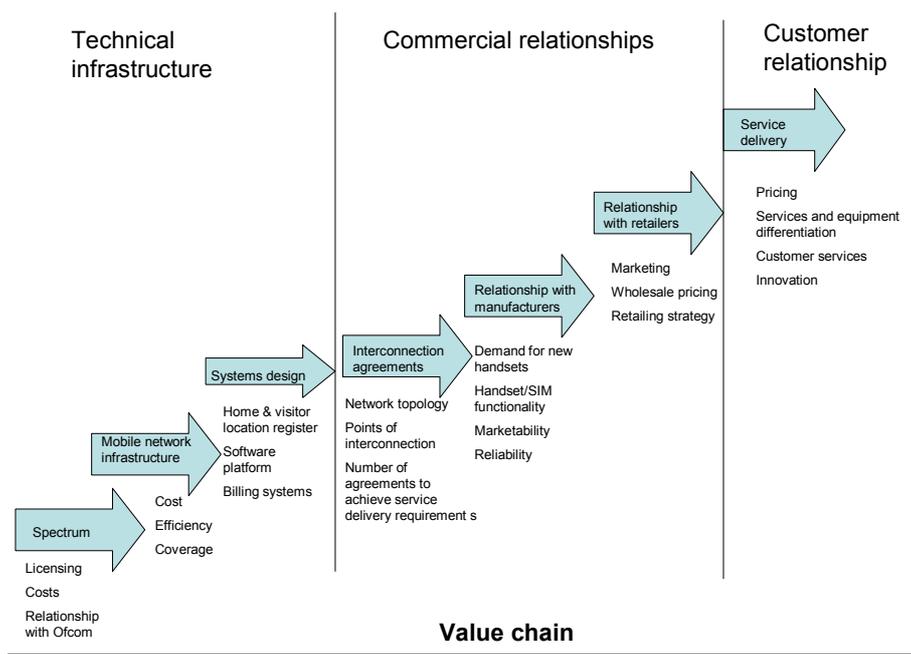
- an overview of UK mobile spectrum and the role of spectrum in the provision of mobile services
- a summary of the international provisions relating to 2G and 3G spectrum
- details of spectrum which is currently licensed for 2G and 3G services

The UK mobile sector

7.2 Mobile technology was first used to deliver commercial services during the mid 1980s. The services delivered by the early mobile operators (Vodafone (then known as Racal) and O2 (then known as BT Cellnet)) used first generation mobile technology. Mobile technology, and the number of operators, has changed significantly since that time. There are now five mobile operators in the UK offering commercial services, four licensed to provide second generation (2G) and third generation (3G) services and one licensed for 3G but able to roam traffic onto a 2G network under a contractual arrangement.

7.3 Spectrum is a key element in the delivery of mobile services. However, as Figure 6 below illustrates spectrum is only one of many inputs that are required to offer mobile services.

Figure 6. Inputs to a mobile service



Development of UK mobile services

- 7.4 In less than twenty years the UK mobile telephony market has grown from the initial deployment of first generation analogue networks, Total Access Communication System (TACS) by Vodafone and O2 in January 1985, to the current position where the UK has five mobile operators.
- 7.5 The first generation analogue networks implemented in the UK provided voice services and little else. The networks were not secure and did not support international roaming.
- 7.6 Second generation systems brought the switch to digital and the introduction of data services in addition to voice. Two new entrants, Orange and One-2-One (now T-Mobile), were licensed. The existing mobile operators (Vodafone and O2), were allowed to 're-farm' their spectrum to allow the provision of Global System for Mobile (GSM) communications services. The analogue networks finally closed in July 2001.
- 7.7 2G services started to appear in the early to mid 1990s. There were still a number of competing standards but a small number became dominant. GSM is the standard adopted across Europe which allowed international roaming to become a reality. GSM is now by far the most widely adopted standard with an estimated 80% of 2G networks worldwide. There are other 2G standards such as cdmaOne and Personal Digital Communication (PDC) but they account for less than 20% of the world wide market and only a small fraction of the European market. The capabilities of the original GSM standard have been greatly extended over the years. Enhancements such as General Packet Radio Service (GPRS) and Enhanced Data Rates for Global Evolution (EDGE) have added packet switched data capabilities and increased data rates significantly (from 9.6 kbps for the original GSM standard to a theoretical maximum of 384 kbps). The UK GSM network operators have now implemented GPRS and offer data rates up to approximately 40 kbps depending on the capabilities of the user terminal. EDGE has yet to be implemented in the UK.
- 7.8 Third generation systems (3G) have also been developed. The first 3G services were introduced in the early 2000s. There is no single international standard. However the International Telecommunication Union (ITU) has developed an umbrella specification (IMT-2000) that incorporates a family of five terrestrial 3G standards (plus a number of mobile satellite specifications). Of these, two seem to be becoming dominant: Universal Mobile Telecommunications System (UMTS / W CDMA) (which is the standard being rolled out across Europe) being adopted by the majority of 3G network operators, with cdma2000 being adopted by most of the rest. Data rates of up to 2 Mbps are possible with planned enhancements, such as high speed downlink packet access (HSDPA), increasing this up to 10 Mbps and beyond. Early trials of HSDPA will take place in the first half of 2005 but in early 3G deployments data rates up to 384 kbps are more realistic.

Current market conditions

- 7.9 There are currently five mobile operators offering services in the UK; Vodafone; O2; T-Mobile; Orange and Hutchinson 3G (H3G). With the exception of H3G, all of the operators have both 2G and 3G spectrum licences enabling them to offer both 2G and 3G services to consumers. Between them, the mobile operators cover over 99% of the UK population and have around 89% geographic coverage. In addition to these network operators there are a wide

range of service providers, including several high street brands, offering alternative retail services on the back of wholesale services provided by the five mobile operators.

- 7.10 The mobile sector is very sizeable in economic terms. Services have a high penetration with around 58m mobile subscribers in the UK (this equates to approximately 97% of the UK population), with total turnover for the mobile sector being £15 bn per annum.
- 7.11 The mobile market in the UK is generally regarded as one of the more competitive in Europe. In August 2003 the then telecommunications regulator, Oftel, found that the market for outgoing services (access and call origination) was not characterised by single or collective dominance. However, there are very high barriers to entry at the network level. At present spectrum policy constitutes an absolute barrier to entry, in that the operation of a mobile telephony network requires an appropriate Wireless Telegraphy Act licence and only nine of these licences have been issued (four 2G and five 3G licences). One effect of Ofcom's proposals on spectrum trading and liberalisation would be to reduce the barriers to entry into the mobile sector.

International provisions relating to 2G and 3G spectrum

- 7.12 The spectrum which is used in the UK for 2G and 3G services is subject to various international harmonisation measures. These are explained in summary form below. These measures have an impact on the policy options which are available to Ofcom particularly in relation to the liberalisation of existing 2G and 3G spectrum.
- 7.13 There are two types of EU harmonisation measure which affect a Member State's flexibility to manage spectrum in the way it chooses:
- Directives: These are addressed to Member States, require transposition into national legislation and are binding in nature; and
 - Decisions: These may also be addressed to Member States or other entities and are binding upon those to whom they are addressed to.
- 7.14 In addition, within the Conference of European Postal and Telecommunications administrations (CEPT) (an organisation of 46 European countries established for co-operation in the field of telecommunications and postal matters) there are harmonisation measures in the form of decisions. Decisions within CEPT are usually developed by one of its major sub-committees. For spectrum matters the relevant committee is the ECC (Electronic Communications Committee) which superseded the former ERC (European Radiocommunications Committee). Decisions on spectrum matters are therefore usually referred to as either ECC Decisions or ERC Decisions depending on when they were developed. These decisions are non-binding in nature, however administrations may voluntarily commit themselves to implement them. Once a commitment is made, an administration is generally considered to be bound by that commitment but can withdraw the commitment at any time if it so wishes.

2G Spectrum

GSM 900

- 7.15 The GSM 900 band (880 – 915 MHz and 925 – 960 MHz) is the subject of an EU Directive (87/372/EEC) generally known as the GSM Directive. This specified the use of 2 x 25 MHz in the band for GSM and provided the framework for the introduction of second generation digital (GSM) mobile telephony services in Europe. It covers 71% of the 900 MHz band which is licensed in the UK to Vodafone and O2.
- 7.16 In addition to this Directive there are two ERC Decisions which together cover the whole of the band. These are:
- ERC Decision (94)01 which has similar requirements to Directive 87/372/EEC;
 - ERC Decision (97)02 complements the Directive by specifying additional 900 MHz spectrum for GSM beyond the original (GSM) frequency bands (The E-GSM band).
- 7.17 These two Decisions have the effect of designating the whole of 900 MHz band for GSM use.

GSM 1800

- 7.18 The GSM 1800 band (1710 – 1785 MHz and 1805 – 1880 MHz) is also the subject of an ERC Decision.
- 7.19 ERC Decision (95)03:
- designates bands in the 1800 MHz range to “DCS 1800”. DCS 1800 is the ETSI standard for GSM operation in the 1800 MHz band and is now known as GSM 1800;
 - requires 2 x 20 MHz to be made available for GSM use by a specified date.

Constraints imposed

- 7.20 These international harmonisation measures affect Ofcom’s discretion to liberalise the 2G bands.
- 7.21 The GSM Directive, being an EU measure, is binding on the UK and, unless repealed or amended, would not allow the frequencies to which it relates to be used for anything other than 2G services.
- 7.22 ERC/ECC Decisions are of a different nature and are not as restrictive in their application. Ofcom believes that it may be possible to liberalise use of the spectrum notwithstanding their existence. The use of the term ‘designates’ when applied to the use of certain frequency bands by particular applications does not imply exclusivity. For instance, the UK has made the entire GSM 900 spectrum available for GSM use. However, if under a future liberalised regime, a licensee decided to use a different application, the band would still technically be ‘available for GSM’ but the market would have decided that a different application was more beneficial.

7.23 Other options in principle are also open to us to if we wish to liberalise use of frequency bands covered by ERC/ECC Decisions. These include renegotiating decisions so that they explicitly align with our requirements and withdrawing our commitment to particular decisions. However, Ofcom would need to take into account its duty to promote the European internal market alongside its other duties which require it to avoid unnecessary restrictions in the licences it grants which limit the potential uses of spectrum.

3G Spectrum

Core 3G Spectrum

7.24 Even as plans for implementing 2G networks took shape and networks started being deployed, planning for the next generation of mobile services had begun. Spectrum for 3G mobile systems was identified at the World Administrative Radio Conference (WARC) in 1992 and this led to what is generally termed “core 3G spectrum”. The bands identified were:

- 1920 – 1980 MHz paired with 2110 – 2170 MHz – for frequency division duplex (FDD);
- 1900 – 1920 MHz – for time division duplex (TDD);
- 2010 – 2025 MHz – for TDD.

7.25 In Europe in December 1998 the EC adopted Decision 128/1999/EC (the UMTS Decision). Pursuant to this, the Commission issued a series of Mandates to CEPT in relation to core 3G spectrum as follows:

- Mandate 1 resulted in CEPT Decision ERC/DEC/(00)01 on making the ‘core’ 3G spectrum available in Europe by 1 January 2002;
- Mandate 2 resulted in CEPT Decision ERC/DEC/(99)25 which detailed the spectrum plan for usage of the ‘core’ 3G spectrum.

7.26 In the UK as discussed further below, this core 3G spectrum with the exception of 2010 – 2025 MHz was awarded in the 3G auction in 2000.

Additional 3G Spectrum

7.27 In addition to the core 3G spectrum other spectrum has also been identified internationally for 3G use. The WRC in 2000 identified the following spectrum:

- 2500 – 2690MHz for future IMT-2000 systems; this band is sometimes referred to as the “3G expansion band”;
- bands at 900 MHz and 1800 MHz currently used extensively for 2G as future IMT-2000 spectrum.

7.28 This led in Europe to CEPT, in response to Mandate 4 from the Commission, adopting Decision ECC/DEC/(02)06 which designated the entire 2500 – 2690 MHz band for terrestrial UMTS/IMT-2000 use to be made available by 1 January 2008 (subject to market demand and national licensing schemes).

7.29 The award in the UK of the 2500 – 2690 MHz band is discussed in more detail in Section 5.

Licensing of 2G and 3G Spectrum in the UK

Current 2G and 3G spectrum holdings

7.30 In the UK 2G spectrum in the two bands (GSM 900 and GSM 1800) is currently licensed to the four national cellular network operators – O2, Orange, T-Mobile and Vodafone for the provision of their GSM networks. Table 7.1 below shows the current spectrum assignments to the four UK 2G operators.

Table 7.1 - Current spectrum assignments to the four UK 2G operators.

Band	Operator	Assignment
GSM 900	O2	2 x 17.2 MHz
	Vodafone	2 x 17.2 MHz
GSM 1800	Orange	2 x 30.0 MHz
	T-Mobile	2 x 30.0 MHz
	O2	2 x 5.8 MHz
	Vodafone	2 x 5.8 MHz

7.31 Within the core 3G spectrum at 2 GHz, Europe has harmonised spectrum for two variants of the UMTS standard. There is 2 x 60 MHz available for frequency division duplex (FDD) systems, 20 MHz is available for licensed time division duplex (TDD) systems with a further 15 MHz set aside for licence exempt TDD systems. In the UK the 3G spectrum is licensed to five operators, these being the four incumbent 2G operators and the new entrant H3G. Table 7.2 below shows the current spectrum assignments to the five UK 3G operators.

Table 7.2 – Current spectrum assignments to the five UK 3G operators

Band	Operator	Assignment
FDD	H3G	2 x 14.6 MHz
	O2	2 x 10.0 MHz
	Orange	2 x 10.0 MHz
	T-Mobile	2 x 10.0 MHz
	Vodafone	2 x 14.8 MHz
TDD	H3G	5.1 MHz
	O2	5.0 MHz
	Orange	5.0 MHz
	T-Mobile	5.0 MHz

2G and 3G Spectrum Awards

2G Licences

- 7.32 The award of the 2G licences in the UK were through comparative selection for the GSM 1800 licences of Orange and T-Mobile and evolution from 1G to 2G (GSM 900) licences for Vodafone and O2. Vodafone and O2 were also awarded a small amount of GSM 1800 spectrum (2 x 5.8 MHz) in order to ensure a relatively equitable assignment of spectrum among the four 2G MNOs. The licences are subject to payment of AIP which is currently charged at the rate of £142,560 per 2 x 200 kHz of GSM 900 spectrum and £110,880 per 2 x 200 kHz of GSM 1800 spectrum.
- 7.33 Wireless Telegraphy Act licences held by the 2G operators are technology specific licences and do not presently allow non-GSM services to be provided.
- 7.34 Unlike most EC Member States, in the UK no end-date has presently been determined for 2G licences. The licences are effectively indefinite in duration, subject to payment of licence fees (including administrative incentive prices). The licences are also held subject to the right of the licensing authority (now Ofcom) to revoke them on a minimum of 1 year's notice. In practice, it is likely that a longer period would be required for revocation.
- 7.35 No other spectrum licences in the UK allow an operator to provide 2G services.

3G Licences

- 7.36 Before the auction in 2000, the Government decided to introduce a fifth operator for the provision of 3G services. Accordingly, in the auction it reserved a licence with the largest spectrum assignment for a new entrant in order to give that company the best chance of competing.
- 7.37 The auction for the existing 3G licences was held in 2000. The auction awarded five licences. Four of these went to the 2G incumbents and the fifth licence, which was reserved for a new entrant, went to TIW, which was subsequently acquired by H3G. A total of 140 MHz of spectrum was licensed between the five licensees with an additional 15MHz set aside for licence exempt use (or possibly light licensing) subject to market demand (the 2010 – 2025 MHz band).
- 7.38 As mentioned in Section 3, the decision to assign the 3G licences by means of an auction reflected the Government's objective of seeking to ensure that the spectrum was awarded to those who valued it most and therefore secure the most beneficial outcome in terms of economic efficiency.
- 7.39 No other spectrum licences in the UK allow an operator to provide 3G services.

Policy issues created by the transition

- 7.40 It should be clear from the above that the structure of the public mobile communications sector in the UK today has in many ways been determined by previous regulatory action. Entry to the sector has only been possible at specific points in time, and the number of new entrants on each occasion has been determined by the Government. Other persons have not been allowed to offer public mobile communications services.

- 7.41 This situation clearly conflicts with the general policy towards spectrum management described in Section 3. Ofcom considers that the extensive regulation inherent in the existing regime creates significant obstacles to the efficient use of spectrum, and to the promotion of competition in the interests of citizens and consumers. These obstacles include, in particular, the absolute barriers to entry into the public mobile communications sector, and the restrictions on the ability of spectrum users to change the way in which they use spectrum to reflect changing market or technological conditions. Both of these types of restriction presently arise as a consequence of regulation.
- 7.42 For the reasons discussed in Section 3, and in the other documents that it has published on spectrum management, Ofcom considers that it is in the interests of efficient use of the radio spectrum and the promotion of competition to extend spectrum trading and liberalisation to 2G and 3G mobile services. As in other areas, these policies should allow spectrum to flow more readily to the users and applications that are of greatest value to society, thus furthering the optimal use of the spectrum. In addition, trading and liberalisation should facilitate additional competition and innovation, as barriers to entry are reduced and additional opportunities are created for entry and expansion. Ofcom also considers that a more technology-neutral approach to regulation should facilitate the entry and adoption of new technologies, thus promoting innovation and investment as well as reducing distortions to competition.
- 7.43 Ofcom does, however, recognise the magnitude of the change implied by the move from the old regulatory regime to the new regime of trading and liberalisation. Each of the licensees in this sector has invested substantial sums in developing their networks against the background of the existing approach to regulation. In particular, large investment programmes are currently under way in deploying 3G networks. Ofcom considers that it is in the interests of citizens and consumers to maintain an environment in which investment by existing licensees continues to be encouraged, as 3G networks, in particular, are likely to bring substantial benefits to the market through innovation. Additional competition has also been brought into the market by the licensing of a new entrant in 2000, and Ofcom welcomes the beneficial effects of this for consumers.
- 7.44 Ofcom therefore considers that it is important to seek a smooth transition in the regulatory regime for mobile spectrum. A transition that is disorderly or excessively rapid could lead to disruption in the market with consequent adverse effects on consumers. Ofcom has therefore taken full account of the importance of acting in a manner that promotes regulatory consistency and predictability.
- 7.45 Ofcom also needs to take account of the potential for the removal of regulation to cause distortions to competition. The Liberalisation Consultation Document set out Ofcom's view that in general spectrum liberalisation should be highly beneficial to competition, by removing unnecessary restrictions on the competitive process. But it also noted that there might be circumstances in which the removal of restrictions could have a distortive effect on competition, depending on the facts of a particular case.
- 7.46 Sections 8 and 9 considers the principal issues that need to be addressed before decisions can be taken on the removal of restrictions on the use of spectrum for mobile services, and on the extension of trading to 2G and 3G bands. In particular, Section 8 addresses the extent to which Ofcom should

maintain existing restrictions on the ability to use other spectrum (not presently licensed for mobile) to offer mobile services. Section 9 considers how and when trading and liberalisation should be extended to the 2G and 3G bands.

- 7.47 Section 10 considers another issue relevant to 3G services, namely how Ofcom will approach enforcement of the roll-out obligations included in 3G licences. It sets out some draft guidance that Ofcom proposes to issue on this topic

Section 8

Removing restrictions on the use of spectrum for mobile services

- 8.1 This Section is the first of two sections which set out Ofcom's current thinking regarding some possible approaches to extending the policies of trading and liberalisation to spectrum used for mobile services. Its focus is on whether restrictions on the use of spectrum for mobile services should be removed.
- 8.2 In principle, a policy of liberalisation implies that licences should be free from restrictions that are not necessary either to avoid undue interference to others or in order to respect international obligations. In relation to mobile services, liberalisation may be effected through the removal of restrictions in existing licences that prevent other users of spectrum from offering mobile services. It may also be effected by issuing new licences on a basis that permits the offering of any service – mobile or fixed – provided that this avoids undue interference and respects international obligations.
- 8.3 In practice, the technical constraints required to prevent undue interference to other users, and the requirements imposed by international agreements, mean that there is limited scope to use much of the spectrum for mobile services. This does not, however, remove the need for Ofcom to address two questions: first, how quickly, and under what conditions, should Ofcom consider the removal of restrictions that prevent the use of non-mobile spectrum for mobile services; second, what if any conditions in this respect should Ofcom impose on spectrum that it assigns in the future.
- 8.4 In brief, Ofcom considers that there are two transitional issues which may justify delaying for a period the removal of restrictions on the provision of public mobile communication services.
- 8.5 The first issue relates to the magnitude of the change in spectrum management that is now under consideration, and also to the potential for the immediate implementation of liberalisation to have an adverse impact on the commercial plans of the five existing public mobile network operators. It is possible that in the short term this could lead to some transitional disruption in the provision of 3G services which might not be in the interests of citizens and consumers. In particular, the five existing public mobile network operators are currently investing substantially in their 3G networks and have hitherto been the only holders of licences to provide 3G services. Under the new approach to spectrum management described in Sections 3 and 4 it is possible that this situation could change. Ofcom considers that, given the particular circumstances in which the existing licences to offer 3G services were acquired, it may be appropriate to have a period of transition to liberalisation that gives the existing licensees appropriate notice of the changes that are in prospect.
- 8.6 The second issue relates to certain licences that have been auctioned in the recent past on the basis that they only allow the provision of fixed services. There is an argument that it would promote the efficient management of the radio spectrum, and promote competition, to remove restrictions on the use of spectrum that has been auctioned. However, there is also an argument that

Ofcom needs to have regard to the fact that, had it been known at the time of those auctions that these licences could be used to provide mobile services, the outcome of those auctions might have been different. In striking a balance between these two considerations, Ofcom may be called upon to decide when it would be appropriate to remove restrictions on these licences, to allow the offering of mobile services.

- 8.7 This Section deals with these transitional issues. It sets out some thoughts on the approach that Ofcom might take to dealing with them. It invites views from respondents on the issues and thoughts.
- 8.8 In practice, Ofcom's policy of liberalisation will be implemented in time through decisions to remove restrictions through the variation of licences, and through determining the terms of new licences. It should be noted that Ofcom is not able to fetter its discretion in relation to future decisions, which must be considered on their merits and in light of all relevant circumstances at the time. In this document Ofcom seeks only to set out the issues for consultation.

Removal of restrictions on providing mobile services other than 3G

Background

- 8.9 Section 7 identifies those bands that are currently licensed in the UK to offer 2G mobile services. At present, other spectrum licences have the effect of restricting all licensees from offering 2G mobile services. In practice, as identified in paragraph 8.3, technical constraints on interference, and international obligations, may constrain Ofcom's ability to remove these restrictions from particular bands. Ofcom may also be limited in its ability to remove such restrictions due to the application in a particular case of Ofcom's statutory duties and other legal rules. However, Ofcom also needs to consider whether such restrictions should be maintained, where there is the possibility that otherwise they might be removed. The same issue arises in relation to the removal of restrictions that prevent users of spectrum from offering mobile services other than 2G, such as other standards that have yet to be developed or that are yet to be deployed in the UK. Issues in relation to restrictions that presently exist on offering 3G services are discussed separately below.
- 8.10 This issue arises in two contexts: first, in relation to spectrum which is already licensed under conditions that restrict its use to a different purpose or technology; and second, in relation to spectrum that is not currently licensed but that may be assigned by Ofcom in the future. In the first context the issue is: what would be Ofcom's approach to removing restrictions on the use of spectrum, to allow the provision of mobile services other than 3G. In the second context the issue is: whether the terms of the licence which would be awarded should include the right to offer mobile services other than 3G.
- 8.11 As explained in Section 3, Ofcom's preferred approach is to remove restrictions on the use of particular spectrum bands as soon as practical since it believes that this will result in a more efficient use of spectrum, have beneficial effects on competition, and so bring benefits to citizens and consumers. The evidence in support of this approach has been set out at length in other documents published by Ofcom, including the Trading Consultation Document, Trading Statement and Liberalisation Consultation Document. Ofcom did not propose any constraint on the removal of restrictions in existing licences that prevent the

use of spectrum for mobile services other than 3G in either the Trading Consultation Document or the Liberalisation Consultation Document.

- 8.12 The discussion below relating to restrictions on the use of spectrum for 3G services (paragraphs 8.29 – 8.69) identifies a number of particular considerations that arise in that case. These considerations do not appear to be relevant in relation to the use of spectrum for mobile services other than 3G. Ofcom is not aware of any other compelling considerations in favour of retaining restrictions that prevent the use of other spectrum for mobile services other than 3G.
- 8.13 Taking account of all the available evidence, Ofcom therefore considers that, where it is possible to do so, removing restrictions in existing licences that prevent licensees from using spectrum for mobile services other than 3G should promote the more efficient use of the spectrum, by enhancing the opportunities for licensees using spectrum for lower value purposes to use it for higher value applications. It may also promote competition in relevant markets, by lowering barriers to entry.
- 8.14 Ofcom also considers that, in general, it is likely to promote the efficient use of spectrum, and competition in relevant markets, not to impose restrictions in future licences awarded by Ofcom that would prevent use of the spectrum for mobile services other than 3G. The avoidance of such restrictions should increase the opportunities for the market to determine the optimum use of the spectrum, thereby improving the efficiency of spectrum use, and helping to promote competition in relevant markets.
- 8.15 Accordingly, Ofcom believes that in general it should be willing to remove licence restrictions (where it is possible to do so under law, and given interference constraints and international obligations) that prevent the use of spectrum for mobile services (other than 3G services) as soon as practicable. There is however a special case of the 3.4 GHz licences, which is discussed below.
- 8.16 Ofcom also considers that in awarding licences in the future (where it is possible to do so under law, and given interference constraints and international obligations) it is likely to be desirable to avoid imposing restrictions on the use of the spectrum that prevent its use for mobile services other than 3G. This issue is particularly relevant to the bands discussed in Sections 5-6, which Ofcom considers may be available for award via a competitive process in 2005-08.
- 8.17 Decisions on the matters discussed in paragraphs 8.15 and 8.16 must be made on their merits, in light of all the relevant circumstances and considerations at the time. However, Ofcom would welcome any reactions from respondents on the issues discussed.

Question 8.1 Do you have any views on the approach that Ofcom should take to restrictions that prevent the use of spectrum for mobile services other than 3G?

Question 8.2 Do you have a view on whether Ofcom should impose restrictions on new spectrum licences to prevent use of the spectrum for mobile services other than 3G?

3.4 GHz licences

- 8.18 In June 2003 15 regional licences were awarded in the 3.4 GHz band following an auction. The licences which were awarded through the auction only allowed the licensee to offer fixed services. In the period before the auction a number of prospective bidders asked if the licences to be awarded could be used to offer mobile services. In response the Radiocommunications Agency (RA) made clear that the offering of mobile services would not be permitted. All these licences are now held by one company, UK Broadband.
- 8.19 In the context of its general policy on liberalisation, Ofcom has been asked from time to time to clarify its position regarding the removal of restrictions from these licences, to allow the use of the spectrum to offer mobile services as well as fixed.
- 8.20 Ofcom is required to consider any request for variation to the terms of a licence on its merits, and in light of all relevant circumstances at the time and in light of Ofcom's statutory duties. Ofcom cannot therefore fetter its discretion as to the approach that it would take in considering a request for the removal of restrictions in these or any other licences, at any time in the future.
- 8.21 Ofcom does however consider that it would be useful to consult the market on certain considerations that might be relevant to the extension of liberalisation to these licences.
- 8.22 In particular, Ofcom would welcome the views of respondents on two different considerations that might be relevant to this issue. The first consideration relates to the wider arguments that have been made in favour of spectrum liberalisation: namely, that it is likely to be in the interest of efficient spectrum management, and the promotion of competition, to remove restrictions from licences as soon as practicable that are not necessary either for compliance with international obligations or for the prevention of undue interference. Ofcom considers that in principle these considerations are as likely to be relevant to the 3.4GHz licences as to any other licensed spectrum. The removal of restrictions that prevent the use of this spectrum for mobile services would enhance the opportunities open to the market for making best use of this spectrum resource. This should in principle promote the efficiency of spectrum use, and help to promote competition.
- 8.23 However, there may be another relevant consideration to which Ofcom should also have regard to in considering the removal of the restrictions on the use of spectrum included in these licences. This is the fact that they were recently auctioned on the basis that the spectrum was for use for fixed services. It is arguable that the immediate removal of restrictions that prevent the use of this spectrum to offer mobile services might be unfair to unsuccessful bidders in the auction held in 2003, and to other parties who did not participate in the auction. This is because, if it had been clear at the time of the auction that the spectrum might be used for mobile services as well as for fixed services, it is possible that the auction might have had a different outcome. It should, however, also be noted that at the time the licences were auctioned, the statutory framework allowed for the possibility that licences might subsequently be varied.
- 8.24 It is possible that one appropriate way of resolving the conflicting considerations in paragraphs 8.22 and 8.23 might be to allow a suitable period of time to elapse following the auction before the removal of restrictions from the licences. It might be argued that the passage of time will alleviate the

problem discussed in paragraph 8.23, as the significance of the auction on the relative economic position of bidders and other parties is likely to decline over time. Unsuccessful bidders will, for example, have the opportunity to pursue other commercial strategies in the interim, and over time may have other opportunities to acquire access to spectrum.

- 8.25 Ofcom would be interested in respondents' views on whether this might indeed be an appropriate means of resolving these conflicting considerations. This issue has been raised in this document in the context of the 3.4GHz licences, but it is also of wider relevance to spectrum licences awarded following a competitive process, both in the past and in the future. Ofcom would therefore also welcome comments on the issue in this wider context.
- 8.26 If respondents agree that the passage of time may be a suitable means of resolving the conflicting considerations in paragraphs 8.22 and 8.23, Ofcom would also welcome comments on what might be an appropriate period of time that should be allowed to elapse. A judgement on this point must depend on the significance of the change to the licence in the light of all relevant considerations, given Ofcom's statutory duties, including the potential effect of removing a particular restriction on the efficiency of spectrum use and the promotion of competition, as balanced against the potential for any unfairness to unsuccessful bidders and others.
- 8.27 It is not clear to Ofcom that it will be either necessary or appropriate to resolve this issue in detail in the near future in relation to the potential removal of any restrictions on the ability to use 3.4GHz licences. However, Ofcom would be interested in respondents' views on the matter, and considers that over time it should be beneficial to the interests of citizens and consumers to seek greater clarity in relation to the extension of liberalisation to this and other bands.
- 8.28 One possibility in relation to the 3.4GHz licences might be to look towards the removal of restrictions on use from 2007. Several considerations might point towards this date. These include the fact that it is approximately four years after the 2003 auction. It might be argued that this should be sufficient passage of time for any effects associated with the terms on which the auction was conducted to have dissipated, either in large part or in whole. This timing would also align with other proposals included in this document relevant to 2G and 3G services, which might also take effect in 2007. This timing might therefore support the wider aim outlined in this document of seeking to achieve an orderly transition from one regime of spectrum management to another, in a manner that is orderly, transparent and not unduly prolonged. There would however be no need to remove restrictions from the use of this spectrum on this or any other timetable if there is no demand in the market for greater flexibility.

Question 8.3 Do you agree that it may be appropriate to allow a period of time to elapse following an auction before extending liberalisation to auctioned licences, through the removal of restrictions as to type of use and technology? Please comment on this issue either as a general matter, or in relation to particular classes of auctioned licences, such as the 3.4 Ghz licences, or both.

Question 8.4 If your answer to question 8.3 is affirmative, do you have a view on the period that might be allowed to elapse before removing restrictions on the 3.4 Ghz licences? We would also be interested in your views on whether we need to seek to resolve this issue at any particular time.

Removal of restrictions on providing 3G mobile services

Background

- 8.29 Section 7 identifies those bands that are presently licensed in the UK for the provision of 3G mobile services. At present, spectrum licences restrict all other licensees from offering 3G mobile services. In practice, as identified in paragraph 8.3, technical constraints on interference and international obligations may constrain Ofcom's ability to remove such restrictions from particular bands. Ofcom may also be limited in its ability to remove such restrictions due to the application in a particular case of Ofcom's statutory duties or other legal rules. However, subject to these constraints, Ofcom needs to consider whether such restrictions should be maintained, where otherwise it might be possible to remove them.
- 8.30 This issue arises in two contexts: first, in relation to spectrum which is already licensed under conditions that restrict its use to a different purpose or technology; and second, in relation to spectrum that is not currently licensed but that may be assigned by Ofcom in the future. In the first context the issue is: what would be Ofcom's approach to removing restrictions on the use of spectrum to allow the provision of 3G mobile services. In the second context the issue is: whether the terms of licences that are assigned by Ofcom in future should include restrictions that prevent the use of that spectrum for the provision of 3G mobile services.
- 8.31 The discussion that follows addresses this issue in relation to bands other than those that are already licensed for 2G use. Section 9 considers the issues in relation to bands already licensed for 2G use, as part of the wider consideration of the possible extension of spectrum trading and liberalisation to those bands.

Responses to the Trading Consultation Document

- 8.32 Ofcom set out a proposal that is relevant to these issues in the Spectrum Trading Consultation (paragraph 8.2.13). In that document it proposed to extend spectrum trading to 3G services by the end of 2007 and stated that Ofcom would not expect to allow change of use, by bands not presently designated for 3G services, to provide 3G services before 2007.
- 8.33 Of the 12 responses received in relation to these issues only one was not broadly supportive of Ofcom's proposal. A number questioned the linkage of trading and liberalisation issues and these and other points made are discussed in Annex D. Ofcom has considered these responses carefully in preparing the proposals included in this document.

Promotion of efficient use of spectrum, competition, innovation, investment and other considerations

- 8.34 As set out in the Trading Consultation Document and subsequently in the Liberalisation Consultation Document, and in this document, Ofcom's general policy is to liberalise the use of spectrum. This policy may be effected either through removing restrictions that impede licensees' ability to use spectrum more efficiently, or through issuing new spectrum licences that contain minimum restrictions as to use, or through both mechanisms. In the case of both existing licences and new licences, there may be constraints on the extent to which restrictions can in practice be removed or reduced, reflecting

international obligations, the potential for harmful interference to third parties, or other constraints imposed by law.

- 8.35 Ofcom's view is that, as a general policy, spectrum liberalisation is likely to promote the more efficient use of spectrum and to promote competition. There should also be other beneficial effects, such as the promotion of innovation by creating more favourable conditions for the introduction and dissemination of new technologies that are economically valuable. As such, Ofcom considers that spectrum liberalisation is an appropriate policy given its statutory duties.
- 8.36 As a matter of principle, these considerations point towards the removal of restrictions in existing licences that prevent the use of that spectrum for 3G services where that spectrum is not presently licensed for 3G services, where this is legally possible. The removal of these restrictions should allow the market rather than the regulator to determine whether this spectrum can be used most efficiently for 3G services. The same considerations also point towards making new licence awards free from restrictions that prevent the use of the spectrum for 3G services. The general arguments in favour of liberalisation also point towards adopting this approach towards existing and new licences as soon as practicable.
- 8.37 Ofcom considers that there are, however, some other relevant considerations that should also be taken into account in considering how the general policy of liberalisation should be given effect in relation to the use of additional spectrum for 3G services. These considerations include the magnitude of the change in policy towards spectrum management that is proposed, and in that context the circumstances of the 3G auction; the scale and importance of the 3G investment programmes that are currently under way; and the existing structure of competition in 3G services.
- 8.38 The 3G auction was held from 6 March 2000 to 27 April 2000. Through the auction, the Government (via the RA) assigned 5 licences to operate 3G services. The spectrum assigned for these purposes was the subject of a European harmonisation Decision, as discussed in paragraphs 7.24-7.25 above. The RA was responsible for assigning rights to future use of the frequencies, the spectrum having been vacated by other users. Following an extensive process of consultation and preparation, the RA decided to award the licences by auction, as the mechanism most likely to promote efficient use of the spectrum.
- 8.39 The 3G auction required important decisions by the RA on the design of the licences to be awarded. Following the process of consultation and preparation the RA decided to offer 5 licences, with some variation in size between them. The largest licence was reserved for a new entrant, consistent with the objectives of the assignment process, which included the promotion of the efficient use of the spectrum available and the promotion of competition in the market for 3G services.
- 8.40 The decisions reached by the RA at the time of the 3G auction reflected careful consideration of the implications for competition in the 3G services market. In particular, the RA took account of the competitive disadvantages that would face a new entrant *vis a vis* the four existing 2G mobile operators, including: the lack of an existing customer base; the lack of licensed access to other spectrum for mobile services; and the lack of an existing 2G mobile network with near-ubiquitous coverage. The decision to reserve the largest spectrum

licence for a new entrant took into account these competitive disadvantages (among other factors), and was intended to provide an advantage that would help to facilitate successful entry.

- 8.41 The 3G auction resulted in substantial expenditure by the licensees to acquire the spectrum licences. The decisions by bidders in the auction, and by other parties that decided not to participate, were made on the basis of the regulatory structure that was described in the Information Memorandum issued to accompany the auction and then implemented in the design of the licences. As set out above, this included key decisions as to the structure of spectrum holdings that were expected to affect the development of competition in 3G services.
- 8.42 Since the 3G auction, substantial further investment has been undertaken by the five 3G licensees. The licensee holding the new entrant licence, H3G, launched commercial services in March 2003 and has recently announced that it has achieved coverage of 80% of the UK by population. Commercial 3G services of various kinds have also been launched, at the time of writing, by Vodafone and Orange and are understood from public announcements to be in preparation by the other licensees, T-Mobile and O2.
- 8.43 The development of the 3G services market has been said by the operators and others to have been generally slower than expected at the time of the 3G auction. In particular, the resolution of issues relating to technical standards is argued by some to have taken longer than expected in the industry at the time of the 3G auction. This is claimed, in turn, to have been partly responsible for the delayed development of handsets meeting the requirements of 3G service providers and consumers. These and other developments are said to have delayed the launch date for commercial services compared to the dates that were expected in the industry immediately following the auction.
- 8.44 In Ofcom's view, the development of competition and innovation in 3G services to date may have been influenced to a significant extent by the design of the 3G auction, including the structure of spectrum assignments that was then put in place. In particular, Ofcom considers that the decision to license a new entrant, and the terms on which the new entrant was licensed, may have played an important role in promoting competition and accelerating the commercial deployment of services. As evidence for this, Ofcom notes statements that have been made by H3G regarding its commercial strategy, and the apparently more rapid deployment of 3G services in those European markets (including the UK, Italy, and Sweden) where a new entrant was licensed as part of the spectrum assignment process.
- 8.45 Ofcom would consider on their merits, and in light of all relevant considerations, at the relevant time, any future decisions on the terms of new spectrum licences, and any requests for the removal of restrictions on existing licences. However, Ofcom believes that a consideration likely to be relevant to any decisions on these matters is the desirability of reducing the risk that the change in approach to spectrum management, discussed in this document, could in the short term have a disruptive effect on the existing competitors providing 3G services in a way which would not be in the interests of consumers. In that regard it currently appears to Ofcom that in the particular circumstances relating to the provision of 3G services, and against the background of the 3G auction, it may be appropriate to have a period of

transition to the implementation of the general policy of liberalisation. Considerations may include:

- The change in policy towards spectrum management described in this document, and in the Trading Consultation Document and the Liberalisation Consultation Document, is a major change in the regulatory environment. Trading and liberalisation were not under discussion at the time of the 3G auction (there was discussion of possible release of additional spectrum). It is possible that policy changes, if introduced in an excessively hasty fashion, could disrupt innovation and investment in 3G services in the short term, which is unlikely to be in the interests of consumers. As new services, with sizeable capital expenditure requirements, the deployment of 3G currently requires significant funding.
- Any effects on the total supply of funding for 3G services are however likely to be short-lived assuming that capital markets are reasonably efficient, and the underlying business case is sound.
- There is rapid evolution in provision of 3G services. Commercial services have only recently been deployed by some operators, and these are continuing to change. New services are being developed by other licensed operators. The services are immature and going through a period of rapid growth.
- The new entrant operator has taken an important role in deploying services commercially and the development of competition. In part, this reflects the structure of licensing put in place at the time of the 3G auction, which seems to have had beneficial effects in promoting competition.

Summary of considerations

- 8.46 Ofcom has reviewed carefully the evidence available to it in relation to the likely effects of spectrum liberalisation on the provision of 3G services. This evidence includes the analysis underpinning the Trading Consultation Document (as set out in that document), the analysis underpinning the Liberalisation Consultation Document (as set out in that document), the responses to both of these consultations (as subsequently published in full, redacted, or summary form), studies into liberalisation published by the European Commission and other bodies (as referenced in publications by Ofcom), and other representations received from 3G licensees and other parties.
- 8.47 Ofcom considers that this evidence suggests strongly that it will be desirable in due course to seek removal of restrictions from existing spectrum licences that prevent this spectrum from being used for 3G services, where this is technically and legally feasible. This should promote the more efficient use of spectrum, by enabling licensees to use spectrum for 3G services if these are of higher value than alternative uses. Ofcom also considers that the removal of these restrictions should promote investment and innovation, by removing obstacles that prevent use of spectrum for additional investment in innovative 3G services. It should also reduce barriers to entry into the provision of 3G services, thus promoting competition.

- 8.48 However, Ofcom is also of the view that, given the considerations set out in paragraphs 8.34 -8.45 , it is appropriate to consider whether the optimal approach, given Ofcom's statutory duties, particularly in relation to the interests of citizens and consumers, would be to allow a period of transition prior to the removal of these restrictions. A period of transition would provide a period of notice to existing licensees, and would help to reduce the risk of short-term disruption to the development of 3G services.
- 8.49 Ofcom's policy on these issues in relation to existing licences would be given effect through decisions to remove or reduce restrictions on the use of spectrum by licence variation. Its policy on these issues in relation to the assignment of new licences would be given effect through decisions on the terms of those licences. For the avoidance of doubt, Ofcom is not presently proposing to make any such decisions.
- 8.50 Rather Ofcom believes that it would be beneficial to consult the market on the approach that it might take on these issues. Accordingly, in this document Ofcom seeks only to set out its current thinking and take the first step towards formulating future guidance on these issues by way of consultation.
- 8.51 Ofcom has therefore set out below a number of options for the approach that it might take towards the removal of restrictions from existing licences, and towards determining the terms of new licences.

Options for general approach – existing licences

- 8.52 Ofcom has identified four alternative approaches that it might take towards the removal of restrictions from existing licences. Other options also exist, but Ofcom considers that for purposes of exposition and analysis these four alternatives usefully illustrate the range of choices available. Under all the options, technical constraints on interference and international obligations are in practice likely to impose significant constraints on Ofcom's ability to remove restrictions. There may also be other constraints that exist as a result of Ofcom's statutory duties or under law.
- 8.53 The options are:
- Option 1 – allow removal of restrictions that prevent use of spectrum for 3G services (subject to the constraints mentioned in previous paragraph) without a transitional period following conclusion of this consultation
 - Option 2 - allow removal of restrictions that prevent use of spectrum for 3G services (subject to the constraints mentioned in previous paragraph) after a transitional period has elapsed; this transitional period might last to 2007 (subject to decisions at the time)
 - Option 3 – allow removal of restrictions that prevent use of spectrum for 3G services (subject to the constraints mentioned in previous paragraph) only after a much longer period has elapsed; this period might last until 2015 (subject to decisions at the time)
 - Option 4 – do not allow the removal of restrictions that prevent use of spectrum for 3G services

8.54 Ofcom has considered these options carefully against a number of criteria, which derive from Ofcom’s statutory duties, including the effect on the efficient use of spectrum, the promotion of competition, effects on investment and innovation, and the extent to which options are consistent with the principles of proportionality, transparency and non-discrimination in regulation. Table 8.1 below sets out the key points of Ofcom’s analysis, including an overview of the extent to which different options promote the interests of citizens and consumers.

Table 8.1 – Summary assessment of the options for removing restrictions on the provision of 3G services in existing licences

Option	Promotion of efficient use of the spectrum	Promotion of competition	Promotion of investment and innovation	Observations on proportionality, transparency and non-discrimination	Promotion of interests of citizens and consumers
1	Would facilitate rapid changes in the use of spectrum from lower to higher value applications.	Likely to promote competition as it will remove barriers to entry created by regulation. But may have a short term adverse effect on continued investment in existing 3G licensees (incumbent and new entrant). This may cause some short term disruption in the development and provision of services by those licensees, though this is likely to be short-term assuming capital markets are efficient and underlying business case is sound.	May have a negative short term effect on continued investment in existing 3G licensees (incumbents and new entrant). This may have a damaging effect on innovation, if the deployment of innovative services is delayed. Effects are likely to be short-term, assuming underlying business case is sound. Longer term effects of reduced regulatory constraints on efficient spectrum use should be beneficial to investment and innovation.	Rapid introduction of major change in regulatory environment with limited notice to existing licensees. Limited opportunities to adapt their behaviour, and potential for perceptions of regulatory inconsistency.. Measures (removal of restrictions) would be transparent as to what they sought to achieve. Measures would also reduce potential for structure of regulation to affect allocation of spectrum between different technologies and different users, by adopting less interventionist, market-based approach more quickly.	Potential for short-term disruption to affect interests of citizens and consumers. Effects should be short-term only, assuming efficient capital markets and sound underlying business case.
2	Would facilitate changes in the use of spectrum from lower to higher value applications. Planning horizon for such changes (2007 and beyond) may be similar to that required for building a commercial network.	Any short-term effect on investment in 3G services in short-term is likely to be more limited than in option 1, given that existing licensees would have an additional opportunity to adapt to the new regulatory environment prior to any change of in regulatory policy.	Any short-term effect on investment and innovation in 3G services is likely to be more limited than in option 1, given that existing licensees would have an additional opportunity to develop innovative services in the market and a period of notice prior to the change in regulatory policy.	This approach would be transparent as to what it sought to achieve, and would be proportionate to the extent that it produced a superior balance between regulatory intervention and benefits to citizens and consumers. Subject to legal and other constraints, the regulator would have indicated its intention to reduce the potential for structure of regulation to affect allocation of spectrum between different technologies and different users	Appears to offer an appropriate balance between objectives, to the benefit of citizens and consumers.

Option	Promotion of efficient use of the spectrum	Promotion of competition	Promotion of investment and innovation	Observations on proportionality, transparency and non-discrimination	Promotion of interests of citizens and consumers
3	Would delay significantly potential changes in the use of spectrum from lower to higher value applications. Risk of long-term distortion in efficient use of spectrum.	Option would avoid any short term disruption in the development and provision of services by those licensees, but would do so at expense of imposing significant restriction on medium- and long-term opportunities for entry into the provision of 3G services.	Investment and innovation by existing 3G licensees less likely to be disrupted in the short-term, but at expense of potential benefits to citizens and consumers of investment and innovation foregone by third parties who might enter into the provision of 3G services. Loss of competitive stimulus to existing 3G licensees in medium and long-term	Measure would not be proportionate to problem, of promoting competition in rapidly developing market that was given a particular market structure via the 3G auction. Given lack of proportionality measure not transparent as to what it would seek to achieve. Risk that long-term distortion in efficient use of spectrum is unduly discriminatory.	Does not appear to offer an appropriate balance between objectives. Avoidance of short-term disruption to present development of competition does not justify long-term restrictions on efficiency of spectrum use and on promotion of competition. Option could impose significant costs to citizens and consumers
4	Would delay indefinitely potential changes in the use of spectrum from lower to higher value applications. Risk of long-term distortion in efficient use of spectrum.	Option would avoid any short-to long-term disruption in the development and provision of services by those licensees, but would do so at expense of restricting opportunities for entry into the provision of 3G services.	Investment and innovation by existing 3G licensees less likely to be disrupted in the short-term, but potential benefits to citizens and consumers of investment and innovation by third parties foregone. Loss of competitive stimulus to existing 3G licensees in medium and long-term.	Measure would not be proportionate to problem, of promoting competition in rapidly developing market that was given a particular market structure via the 3G auction. Given lack of proportionality measure not transparent as to what it would seek to achieve. Risk that long-term distortion in efficient use of spectrum is unduly discriminatory.	Does not appear to offer an appropriate balance between objectives. Option could impose significant costs to citizens and consumers

8.55 Ofcom's preliminary conclusion is that options 3 and 4 do not appear to offer an appropriate balance between the relevant considerations identified in the above table. Option 1 has merits. However, it would only provide the existing 3G licensees with very limited notice of the introduction of the new approach to spectrum management. Given the particular circumstances under which they acquired the spectrum (compared to most other licensees to date) in the auction in 2000, and the nascent nature of the provision of 3G services, option 1 risks some short-term disruption to the development of provision of 3G services. This could be damaging to the interests of citizens and consumers. Option 2 appears to offer an appropriate balance between the relevant considerations identified in the table, and seeks to maximise the interests of citizens and consumers. It strikes a balance between the need to minimise any short term disruption to the five existing licensees against other considerations, in particular the need to promote efficient use of the spectrum and to promote competition. Accordingly, this is the approach that Ofcom is presently minded to prefer in relation to the removal of restrictions from existing licences.

Question 8.5 Do you consider that the criteria used above are the most relevant considerations in relation to the potential removal of restrictions on offering 3G mobile services? Do you have any views on the approach that Ofcom should take towards removing restrictions in existing spectrum licences that prevent use of the spectrum to provide 3G mobile services? Which of options 1-4 above do you think offers an appropriate balance between those considerations that are relevant?

Options for general approach – new licence awards

8.56 In a similar manner, Ofcom has identified four alternative approaches that it might take towards the terms on which new licences might be awarded. Other options also exist, but Ofcom considers that for purposes of exposition and analysis these four alternatives usefully illustrate the range of choices available. Under all the options, technical constraints on interference and international obligations may in certain cases impose constraints on the terms of licences that may be awarded.

8.57 This issue is particularly relevant to the terms of new licences that may be awarded following a competitive process, including those in bands that are discussed in sections 4, 5 and 6 of this document. In these cases Ofcom will need to decide the appropriate terms of the licences, prior to the award process. The discussion that follows addresses these cases, rather than licences in other bands that are presently awarded on-demand. Ofcom has other processes in train (as described in the Trading Statement) to make proposals for changes to the terms of various classes of on-demand licence, for example in private business radio.

8.58 The four options are:

- Option 1 – do not impose any restrictions on the terms of new licence awards that prevent use of spectrum for 3G services (subject to the constraints mentioned above); adopt this approach with effect from conclusion of this consultation, in relation to all spectrum licences awarded under a competitive process;
- Option 2 - impose restrictions on the terms of new licence awards that prevent use of spectrum for 3G services, but these restrictions should only have a temporary life (subject to the constraints mentioned above), and would last only to 2007
- Option 3 – impose restrictions on the terms of new licence awards that prevent use of spectrum for 3G services for a much longer period; this period might last until 2015 (subject to the constraints mentioned above)
- Option 4 – impose restrictions on the terms of new licence awards that prevent use of spectrum for 3G services indefinitely

8.59 Ofcom's general approach towards spectrum policy is to allow maximum freedom for the market to determine the optimum use of the spectrum, and therefore to impose the minimum restrictions necessary. The rationale for considering a transitional period towards the implementation of liberalisation in this case is to allow an orderly transition from the previous approach to spectrum management, to reduce the risk of disruption, in the interests of citizens and consumers. However, in the case of certain bands that may be the subject of new licence awards, there are already extant proposals at European

level that they may be used for 3G services. In particular, this is the case with the 2010 – 2025 MHz and 2500 – 2690 MHz bands discussed in Sections 5 and 7. The potential use of these bands for 3G services has already been widely discussed and the possibility that these bands might be available for 3G services has been known for some years. Ofcom therefore considers that there is no justification for now imposing additional constraints on the use of these bands for 3G services. These bands are therefore outside the scope of options 1-4.

8.60 Ofcom has considered these options carefully against a number of criteria (which derive, broadly, from statutory duties), including the effect on the efficient use of spectrum, the promotion of competition, effects on investment and innovation, and the extent to which options are consistent with the principles of proportionality, transparency and non-discrimination in regulation. Table 8.2 below sets out the key points of Ofcom's analysis, including an overview of the extent to which different options promote the interests of citizens and consumers.

Table 8.2 - Summary assessment of the options for including or excluding restrictions on the provision of 3G services in new licences

Option	Promotion of efficient use of the spectrum	Promotion of competition	Promotion of investment and innovation	Observations on proportionality, transparency and non-discrimination	Promotion of interests of citizens and consumers
1	Would impose no constraints on the optimum use of the spectrum from the time of award.	Likely to promote competition as it will remove barriers to entry created by regulation. But may cause concern about potential for some short term disruption in the development and provision of services by existing licensees, though this is likely to be short-term assuming capital markets are efficient and underlying business case is sound.	May have a negative effect on continued investment in existing 3G licensees (incumbents and new entrant). Effects of reductions in barriers to entry should be beneficial to investment and innovation in longer term. Greatest clarity of all options in definition of terms of licences for new spectrum awards; should help to attract interest in using spectrum and investing in services.	Minimum restrictions imposed on choice of technologies and type of use. Approach likely to minimise any potential for undue discrimination.	There may be concern about the risk of disruption to the development of 3G services by existing licensees. However, any effects should be short-term only, and are likely to be modest at most given time required for roll-out of new services. Availability of additional spectrum, under flexible conditions, should benefit efficiency of spectrum use in medium- to long-term. Additional opportunities for entry should promote competition and innovation.
2	May create some delay in optimum use of spectrum. Practical effect is likely to be limited given time required for roll-out of a commercial	Existing licensees would have an additional opportunity to adapt prior to restriction on new spectrum awards expiring.	Existing licensees would have an additional opportunity to adapt prior to restriction on new spectrum awards expiring.	Restrictions on use of spectrum for 3G services may affect bidders' choice of technologies in award process. But practical effect is likely to be limited given the time required for roll-out of	Likely to reduce any short-term disruption to development of 3G services. But may raise concerns about effect on choice

Option	Promotion of efficient use of the spectrum	Promotion of competition	Promotion of investment and innovation	Observations on proportionality, transparency and non-discrimination	Promotion of interests of citizens and consumers
	network. This time period is likely to be similar to period between licence award (in 2005-06) and cessation of any restriction in 2007. Additional complexity in spectrum licences may create some uncertainty for bidders and others.	Additional complexity in spectrum licences available for award may deter interest, and this may reduce competitive interest in acquisition and use of spectrum.	Additional complexity in spectrum licences available for award may deter interest, and this may reduce spur to innovation and investment that may be created via spectrum award process.	<p>Observations on proportionality, transparency and non-discrimination</p> <p>a commercial network.</p> <p>This approach would be proportionate to the extent that it produced a superior balance between regulatory intervention and benefits to citizens and consumers.</p> <p>It should also be transparent as to what it seeks to achieve if justified by aim of continued development of competition, innovation and investment in 3G services.</p>	Promotion of technologies and additional complexity of licensing process.
3	Would delay significantly potential optimal use of the spectrum. Risk of long-term distortion in efficient use of spectrum.	Option would avoid any short-term disruption in the development and provision of services by those licensees, but would do so at expense of imposing significant restriction on medium- and long-term opportunities for entry into the provision of 3G services.	Investment and innovation by existing 3G licensees may be less likely to be disrupted in short-term, but at expense of potential benefits to citizens and consumers of investment and innovation foregone by third parties who might enter into the provision of 3G services. Loss of competitive stimulus to existing 3G licensees in medium and long-term	Measure would not be proportionate to problem, of promoting competition in rapidly developing market that was given a particular market structure via the 3G auction. Given lack of proportionality measure not transparent as to what it would seek to achieve. Risk that long-term distortion in efficient use of spectrum is unduly discriminatory.	Does not appear to offer an appropriate balance between objectives. Avoidance of short-term disruption to present development of competition does not justify long-term restrictions on efficiency of spectrum use and on promotion of competition. Option could impose significant costs to citizens and consumers
4	Would delay indefinitely potential changes in the use of spectrum from lower to higher value applications. Risk of long-term distortion in efficient use of spectrum.	Option would avoid any short-to long-term disruption in the development and provision of services by those licensees, but would do so at expense of restricting indefinitely opportunities for entry into the provision of 3G services.	Investment and innovation by existing 3G licensees may be less likely to be disrupted in short-term, but potential benefits to citizens and consumers of investment and innovation by third parties foregone. Loss of competitive stimulus to existing 3G licensees in medium and long-term	Measure would not be proportionate to problem, of promoting competition in rapidly developing market that was given a particular market structure via the 3G auction. Given lack of proportionality measure not transparent as to what it would seek to achieve. Risk that long-term distortion in efficient use of spectrum is unduly discriminatory.	Does not appear to offer an appropriate balance between objectives. Option could impose significant costs to citizens and consumers

- 8.61 Ofcom's conclusion is option 1 and 2 both have merits. Ofcom has noted potential concerns under Option 2 about the potential for temporary restrictions on the use of spectrum to create additional uncertainty for bidders and others. This may have an adverse effect on the efficiency of the award process, and thereby on the efficiency of spectrum use, and on the promotion of competition and innovation. There may also be concerns about the potential effect on bidders' choices between different technologies.
- 8.62 Set against these points, Ofcom considers that weight also needs to be attached to the arguments discussed in paragraphs 8.34-8.45 about the potential for short-term disruption to the present development of 3G services by the existing licensees. This could be damaging to the interests of citizens and consumers, and may weigh against Option 1.
- 8.63 It should be noted that in practice any benefits conferred by Option 2 may be limited given the time required for roll-out of a commercial network, following licence award. It is also relevant that other spectrum may also be made available during this period (in the 2010-2025 MHz and 2500-2690 MHz bands) that is free from any restrictions as to use for 3G services.
- 8.64 Ofcom considers that the choice between Options 1 and 2 appears to be finely balanced. Ofcom seeks views from respondents on the choice between the options.

Question 8.6 Do you consider that the criteria used above are the most relevant considerations in relation to the application of liberalisation to the award of new licences and the opportunity to offer 3G services?

Question 8.7 Ofcom seeks views from interested parties on the approach that it should take to the award of new licences (other than in the 2010-2025 MHz and 2500-2690 MHz bands), and whether these should contain any restrictions as to use of the spectrum to offer 3G services. Do you have any views on which of the options discussed offers the most appropriate balance between relevant considerations?

Definition of 3G services

- 8.65 Ofcom considers it beneficial to the consultation process on Section 8, to provide some initial views as to how it might in future define the term "3G services". If Ofcom does adopt one of the approaches described above, then (without fettering its discretion) it would be important to give guidance to the market on Ofcom's preferred approach to how in practice it will deal with the task of differentiating 3G services from other services.
- 8.66 In developing these initial views, Ofcom has focussed on considering the range of possible technical specifications and the functionality offered under existing 2G licences and under the existing and prospective 3G systems of the five existing licensees. Its initial view is that services might be regarded as 3G if they pass all of the following four tests:
- 8.67 The service:
- Uses one of the IMT 2000 family of radio interfaces;
 - Offers truly mobile functionality ie functions at greater than 10km per hour;

- Provides automatic hand-over between cells for seamless connectivity; and
- Provides effective user data rates at greater than 58 kbps in either the uplink or downlink.

8.68 The effective user data rate figure represents what Ofcom considers to be a practical maximum that could be provided by a 2G network using GSM/GPRS. It is based on the use of up to four timeslots in either the uplink or downlink providing a user data rate of up to approximately 14.4 kbps per timeslot.

8.69 Ofcom recognises that it may be appropriate to take a broader approach to the definition and also take into account other services which may offer an end-user similar functionality. It will consider this issue further in the light of the responses to this consultation and when it comes to make its decisions either in relation to variations of existing licences or award of new licences.

Question 8.8 Do you have a view on whether it is useful to have a working definition of the term “3G services”? If so, do you agree with the definition set out for illustrative purposes above?

Next steps

8.70 Following this consultation, Ofcom will review carefully all responses received. Ofcom will also consider the outcome of the economic study discussed in Section 9, to the extent that this may be relevant to the issues discussed in this section. Views will also be sought from stakeholders on the economic study, and responses on this will also be considered carefully to the extent that they are relevant to the issues discussed in this section.

8.71 Ofcom may then issue a Statement that sets out its conclusions on some or all of the matters discussed in this section. To the extent that this section discusses issues which will be the subject of separate and subsequent decisions, respondents should recognise that any Statement may contain non-binding guidance only, and that Ofcom is unable to fetter its discretion as to the final decisions that it makes. Ofcom may alternatively decide not to issue a Statement at this time, and instead to consider the issues in the context of decisions on the removal of restrictions from existing licences and/or decisions on the terms of new licences to be made available for award.

8.72 Any Statement may be issued in summer 2005. Subject to the outcome of consultation on other sections of this document Ofcom may seek to make decisions later in 2005 as to the terms of licences made available for award in 2005-06. Ofcom may consider proposals for variations to licences at any time, and will consider these in light of all relevant circumstances and in light of its statutory duties.

Section 9

Trading and liberalisation in existing 2G and 3G bands

- 9.1 This section addresses the potential extension of spectrum trading and liberalisation to the bands currently licensed for 2G services and for 3G services. These bands were identified in section 7 of this document.
- 9.2 The section considers a number of issues in turn. First, it considers the extent to which it may be desirable to seek to resolve the issues discussed here now, or whether it may be more appropriate to delay resolution until more information is available to Ofcom and to the market. There is then a discussion in outline of the issues that may be raised by the potential liberalisation of existing 2G spectrum. This is followed by a discussion of the issues that may be raised by the potential extension of trading to existing 2G spectrum. Finally, there is a brief discussion of the issues that may be raised by the potential extension of spectrum trading and liberalisation to the bands currently licensed for 3G services.
- 9.3 This ordering reflects the fact that, as discussed below, Ofcom considers that there are a number of issues that need to be addressed before any decisions can be reached on the timing and means by which the restrictions that presently exist on the use of the 2G bands might be removed. It seems appropriate to consider these issues before addressing other aspects of the application of trading and liberalisation to the 2G and 3G bands.

Relevance of these issues

- 9.4 It is worth considering first the extent to which these issues of trading and liberalisation in the 2G and 3G bands need to be addressed now. 2G spectrum is currently heavily used, and 2G services have expanded very significantly in recent years. It seems very likely that use of this spectrum for 2G services currently represents the most efficient use in the interests of citizens and consumers, and this situation may continue to obtain for a number of years. By the same token, the use of 3G spectrum for 3G services is presently at an early stage of development. As discussed in Section 8, very large sums have recently been invested in developing these services, and it seems likely that existing licensees will wish to retain the spectrum in this use to maximise their return.
- 9.5 It is not therefore obvious that the terms on which 2G and 3G spectrum might be made tradeable, or useable for other services, are pressing issues of regulatory policy. However, Ofcom considers that the issue does merit some discussion now, for three reasons.
- 9.6 The first relates to the case for clarifying as a matter of policy the basis on which spectrum trading and liberalisation might be extended to the existing 2G and 3G bands. Ofcom has set out detailed proposals for implementing spectrum trading and liberalisation across large parts of the radio spectrum. 2G and 3G mobile services are among the most important uses of the spectrum in economic terms. It would leave some uncertainty in relation to the meaning of

these policies if Ofcom were not to address the way in which they might be applied to 2G and 3G spectrum.

- 9.7 The second reason relates to Ofcom's proposals for releasing additional spectrum into the market, as set out in sections 4-6 of this document. Ofcom is proposing to release a number of bands that might be used for 2G and 3G mobile services, among many other possible applications. It is possible that the existing 2G and 3G mobile operators may have an interest in acquiring this spectrum. In that case, these parties are likely to seek greater clarity as to the terms on which they can use existing spectrum, including any flexibility as to use, to make it easier to judge whether to acquire additional spectrum.
- 9.8 Finally, Ofcom is aware that the lead time for investment decisions in relation to mobile networks is long. This reflects, among other considerations, the time required to obtain any planning consents and the scale and complexity of the investment required in the network and supporting systems. From its understanding of the market, Ofcom considers that there is a wide range of possible scenarios for the future development of 2G and 3G services in the UK. Under some of these scenarios, it is possible that some traffic may migrate from 2G to 3G networks. In the longer term, consideration is already being given in various fora to the potential for 'beyond 3G' or '4G' networks. In principle, it is likely to be desirable to achieve greater clarity in the regulatory framework as this may facilitate more efficient decision-making by existing operators and potential new entrants.
- 9.9 However, it is important to stress that there may also be arguments against seeking a premature resolution of the issues discussed in this Section. As noted, there are uncertainties regarding the development of mobile services over the next few years. There may also be uncertainties regarding some of the issues discussed below (including, for example, the possible effects of 2G liberalisation on the promotion of competition). Any uncertainties may diminish with time. There may therefore be circumstances in which the appropriate course of action for Ofcom is not to seek to resolve a particular issue in the near future, but to await the availability of additional information.
- 9.10 It is also important to be clear that Ofcom does not regard prior resolution of any of the issues discussed in this section as a pre-condition for proceeding with the release of unused or under-used spectrum into the market. As discussed in sections 4-6, Ofcom considers that there is a wide range of alternative potential uses and users for the spectrum that is available for award. Ofcom considers that it is unlikely to promote the efficient use of spectrum to delay making the spectrum available pending resolution of the issues discussed in this section. Such an approach would risk sterilising the use of a number of blocks of spectrum, resulting in inefficient spectrum use, and reducing the benefits to citizens and consumers that are likely to flow from additional spectrum awards, including the potential stimulus to competition, innovation and investment.

Question 9.1 Do you have a view on the appropriate timing for seeking to resolve the issues discussed in this Section?

Liberalisation of 2G Spectrum

Background

- 9.11 As explained in section 7, the spectrum presently used for 2G services is held under licences that restrict the type of services that may be offered and the technical characteristics of those services. The effect of these restrictions is to limit the purpose of transmission to 2G GSM use. As with other spectrum bands, liberalisation of the spectrum presently used for 2G services will be achieved when it can be used without such restrictions, other than restrictions that may be required in order to ensure compliance with international obligations, to avoid undue interference to third parties or for other reason of law.
- 9.12 Restrictions of this kind may in principle be removed through one or more of a number of mechanisms. These include:
- the variation of licences, either individually or as a class, either following a request from a licensee or at Ofcom's own initiative; and
 - the issue of new licences that are free from existing restrictions, and that might be held either by existing licensees or by third parties; new licences might be formulated in a number of ways, which might perhaps include a definition of technology-neutral spectrum usage rights (as recently outlined in the SFR).
- 9.13 The discussion of liberalisation that follows does not predetermine the form that liberalisation of the spectrum presently used for 2G services might take, or the timing of progress towards it.

General policy and its relevance to 2G spectrum

- 9.14 Ofcom's general policies in relation to spectrum trading and liberalisation have been described in Sections 3 and 7 of this document, and in more detail in other publications including the Trading Consultation Document, the Trading Statement, the Liberalisation Consultation Document, and the SFR.
- 9.15 These documents did not, however, include any detailed discussion of the extension of liberalisation to the existing 2G spectrum. The issue was discussed briefly in the Trading Consultation Document which noted (paragraph 8.2.11) that there may be policy objectives that justify the delayed introduction of liberalisation for certain licence classes (including 2G and 3G), and which mentioned the fact that decisions on the refarming of 2G spectrum were awaited. Ofcom has considered all relevant responses on this issue carefully prior to publishing this document. A summary of these responses is included in Annex D.
- 9.16 The Liberalisation Consultation Document was specific in excluding from its scope the issues around the application of liberalisation to mobile services. A number of respondents did however comment specifically on these issues in their responses. Ofcom will take account of these comments, alongside responses to this document, in considering the way forward following this consultation.
- 9.17 As stated elsewhere in this document (including in sections 3 and 7), Ofcom considers that in due course the removal of unnecessary restrictions on the use

of the spectrum that is presently used for 2G services should bring benefits to citizens and consumers. Once liberalisation has been extended to this spectrum, there will be greater freedom for the market to determine the appropriate use of the spectrum, subject only to restrictions required (as in other licence classes) to ensure compliance with international obligations, to avoid undue interference to third parties, or to meet other restrictions of law.

- 9.18 For reasons that have already been articulated in the Trading Consultation Document, the Trading Statement, the Liberalisation Consultation Document, and the SFR and summarised in Section 3 of this document, Ofcom considers that a market-based approach to spectrum management is likely to be more effective at promoting efficient use of the spectrum than an approach based on judgement by the regulator as to the optimum use of each frequency. This should allow use of the spectrum to be more flexible and responsive to changing market conditions. This in turn should bring further benefits to citizens and consumers through the promotion of competition, in particular by reducing regulatory barriers to entry, and improvements in the conditions for innovation and investment in wireless services. The removal of restrictions that are no longer required is also consistent with the requirements on Ofcom to ensure that licence conditions are objectively justified and proportionate, and with the duty to keep regulatory burdens under review, with a view to minimising unnecessary regulation.

Constraints on liberalisation of 2G spectrum

- 9.19 As a general matter, these considerations seem likely to apply with as much force to the bands presently used for 2G spectrum as to any other part of the spectrum. However, there are a number of constraints that exist on the extent to which liberalisation may be extended to the existing 2G bands.
- 9.20 One type of constraint comprises technical restrictions on the extent to which alternative uses may be possible. In principle, these are similar in character to the technical restrictions that exist in relation to the removal of restrictions on the use of other bands.
- 9.21 A second type of constraint relates to existing international obligations. As discussed in section 7, the existing 2G bands are subject to a number of European harmonisation measures, including ERC decisions and the GSM Directive (87/372/EEC). Ofcom will not be able to remove restrictions relating to the use of this spectrum if this would create a potential conflict with ensuring compliance with international obligations that are binding on the UK. The international obligations that presently apply to the 2G spectrum are substantial, and more extensive than those that exist in many other bands. Ofcom will need to take careful account of the implications of these obligations as it develops policy on the issues discussed in this document.
- 9.22 Subject to further consideration of the appropriate course of action, in light of all relevant circumstances, in Ofcom's view the existing ERC decisions need not prevent liberalising use of relevant parts of the 2G spectrum.
- 9.23 However, the GSM Directive (which affects part of the 900 MHz band) is more complex. This Directive governs the use of certain frequencies in the 900 MHz range, and Ofcom's interpretation is that it restricts use of those frequencies to the ETSI GSM standard. The frequencies affected by this restriction represent approximately 71% of the spectrum licensed for 2G services around 900 MHz

and 22% of all spectrum presently licensed for 2G services. The Directive only affects some of the existing licences, namely those held by Vodafone and O2.

- 9.24 Ofcom considers that in assessing options for taking forward liberalisation it will need to consider the implications of the GSM Directive carefully. Unless amended or repealed, the Directive could reduce significantly the benefits associated with liberalisation of the 2G bands. It could also result in a policy of liberalisation having different effects on different 2G MNOs.
- 9.25 A third type of potential constraint relates to the scope for new international obligations in the future. These might take the form of new measures that may have binding effect on the UK, and/or changes to existing measures that have new binding effects. In this context, Ofcom will consider carefully the implications of its general approach to spectrum management for future discussions in international fora on obligations that could affect use of the existing 2G bands.
- 9.26 In the SFR, Ofcom included some initial proposals on the general matter of the relationship between harmonisation measures and market-based spectrum management. Ofcom identified the risks of inappropriate harmonisation, and the case for a gradual transfer of harmonisation activities to the market, but Ofcom also noted that harmonisation measures may have net benefits in some circumstances. A careful consideration of all relevant factors, including costs and benefits, should be undertaken before any new harmonisation measure is agreed.
- 9.27 Ofcom has noted the representations made in response to the Spectrum Trading Consultation on the relevance of harmonisation to mobile services, given in particular the scope for consumer benefits from roaming. Ofcom will take account of these points in developing its approach both to the future of existing 2G spectrum and harmonisation policy. However, Ofcom's view is that the benefits of harmonisation in relation to the present use of 2G spectrum have now very largely been achieved, given the widespread availability of GSM handsets and networks. It is not clear that regulatory restrictions that limit use of this spectrum to 2G services continue to be required in order to secure consumer benefits from the availability of roaming. Were regulation absent, market forces would be likely to ensure the continued supply of roaming services to consumers.
- 9.28 It is a separate matter, that would require detailed analysis encompassing both costs and benefits, whether a new harmonisation measure specifying the use of the existing 2G spectrum for another purpose would be justified. That issue is outside the scope of this document.

Question 9.2 Do you consider that there should, in principle, be benefits from extending liberalisation to the spectrum presently used for 2G services, so that there is greater flexibility for the market to determine optimum use?

Question 9.3 Do you have any comments on the significance of the constraints on liberalisation of 2G spectrum that are likely to flow from (a) technical constraints, to avoid undue interference, or (b) international obligations? What approach should Ofcom take to the liberalisation of the 2G spectrum, given the international obligations? And what approach should Ofcom take to those harmonisation measures that are relevant to the existing 2G spectrum?

Additional complication in relation to structure of competition

- 9.29 There is one further important issue in relation to the potential liberalisation of the 2G spectrum, that distinguishes the choices relating to this spectrum from other bands in relation to which Ofcom has so far made proposals for liberalisation. This is the market structure for the provision of 3G services that was created through the 3G auction in 2000.
- 9.30 As discussed in Section 8, prior to the 3G auction in 2000 the Government (through the RA) decided to offer five licences with some variation in size between them, and to reserve the largest of these licences for a new entrant. This new entrant was expected to constitute a fifth mobile operator, stimulating competition in the provision of 3G services alongside other operators.
- 9.31 As a consequence of the auction and subsequent processes, H3G is now actively competing in the market for 3G services, having invested very substantial sums in acquisition of the licence and subsequent roll-out of its network and services. As discussed in section 8, Ofcom considers that the decision to license a new entrant, and the terms on which the new entrant was licensed, may have played an important role in promoting competition and innovation and in accelerating the commercial deployment of 3G services.
- 9.32 The 3G auction led to five companies being licensed to provide 3G services in the UK. As discussed in Section 7, four of these are also incumbent 2G MNOs. Each of these four parties holds licences for both 2G and 3G spectrum. The fifth 3G licensee, H3G, holds only 3G spectrum, but holds the largest assignment of this spectrum, in a market structure that was intended at least in part to offset disadvantages that may arise from new entrant status.
- 9.33 Ofcom considers that the structure of the 3G auction was carefully designed to achieve a particular market structure that would promote competition in 3G services. Ofcom also considers that, on the basis of the limited evidence to date, this structure seems to be operating successfully in achieving its objectives.
- 9.34 As discussed in Section 7, Ofcom considers that the regulatory structure that has existed to date in relation to 3G services is unlikely to be optimal in the future. In particular, the existence of restrictions on other licences that prevent use of that spectrum for 3G services is unlikely to promote optimal use of the spectrum, given that it imposes constraints on the ability to use that spectrum more efficiently. These restrictions are also unlikely to be optimal in terms of promoting competition, as they effectively create regulatory barriers to entry into the provision of 3G services. Section 7 has included consideration of the potential for removing restrictions on licences other than those for the existing 2G bands, to remove constraints on offering 3G services, to improve the efficiency of spectrum use and to reduce barriers to entry.
- 9.35 However, in the case of the spectrum presently licensed for 2G services, some additional relevant considerations arise. Given that four of the five 3G licensees hold 2G licences, but the fifth (new entrant) operator does not, it is possible that variations in the terms of the 2G licences held by existing licensees could have a different effect on the competitive position of one party compared to the other four. This might have a disadvantageous effect on the new entrant, compared to the incumbent operators. This in turn might have a negative effect on the promotion of competition, to the detriment of citizens and consumers.

- 9.36 Given these considerations, and the careful structuring of licences that was undertaken for the 3G auction, Ofcom considers that particular care and thought is needed in relation to any further change in the 2G spectrum licences that could affect the competitive position of H3G vis a vis the existing four 2G licensees.

Question 9.4 In your view, how relevant is the structure of competition in 3G services established by the 3G auction to considering the potential extension of liberalisation to the existing 2G bands?

Initial discussion of possible effects

- 9.37 Ofcom believes it is necessary to analyse carefully as an empirical matter whether the removal of restrictions on the use of existing 2G spectrum could in some circumstances have a material adverse impact on the competitive position of different parties and more widely on the process of competition. This empirical analysis needs to take account of the constraints imposed by existing international obligations, in particular the GSM Directive, as well as the effects of the structure of competition created by the 3G auction. The empirical analysis will also need to address the effects that different policies might have on the efficiency of spectrum use, and on Ofcom's other statutory duties.
- 9.38 Ofcom is therefore planning to undertake a detailed economic study of these issues with the assistance of external consultants. Ofcom envisages that when the study is completed interested parties will have an appropriate opportunity to comment on its findings before Ofcom takes the matter any further forward. It may however be useful to identify briefly now some of the effects that might be associated with removal of restrictions on use of the existing 2G spectrum, and why these might be relevant to promoting the efficient use of spectrum, the promotion of competition, and other considerations.
- 9.39 Ofcom's preliminary view is that the empirical issues are likely to have a number of different aspects. For example, it will be necessary to consider the effect that liberalisation of the 2G spectrum (whatever the mechanism by which it is achieved) might have on the efficiency of spectrum use. What, for example, are the potential efficiency gains associated with one or more of: enabling uses that are higher value than 2G; enabling 3G or other services to be provided at lower cost; facilitating the introduction of innovative applications?
- 9.40 It will also be appropriate to consider the effect that removing restrictions on the existing 2G licensees' use of the spectrum might have (as one mechanism for effecting liberalisation) on existing 2G licensees' competitive position relative to each other, and to other parties. This analysis would need to consider scenarios in which existing international obligations have changed, and those in which they have not.
- 9.41 In principle, it seems possible that there could be various effects on existing 2G licensees, such as: increased spectrum availability, providing extra capacity for 3G or other services; potential effects due to the certainty that this spectrum will be available for a wider range of uses (ie an option value); the potential for lower coverage costs associated with use of lower frequencies; and the potential for windfall gains or losses, resulting from changes in the value of spectrum due to liberalisation.

- 9.42 Depending on the results of this analysis, it may then be necessary to consider the effect that changes in the competitive position of different parties might have on the promotion of competition in relevant markets, and in particular whether these changes are likely to result in material adverse impacts on efficient competition. It is likely to be important to make this assessment in a dynamic sense and to consider the extent to which any effects on existing 2G licensees can be matched or replicated by competitors in relevant downstream markets. This will need to take account of the likely availability of additional spectrum, following release of the bands discussed in Sections 4-6.
- 9.43 The breadth of the definition of the relevant downstream markets is also likely to be relevant. For example, if in future there were a large number of players able to provide 3G services, or services substitutable for 3G services, using a variety of spectrum bands, then an adverse effect on one competitor (or class of competitor) might not imply any material effect on competition. Harm to competition is usually associated with a detriment to consumers, such as higher prices, lower output, or less choice and innovation. It may be necessary to consider whether changes of the kind discussed would be likely to have harmful effects on consumers as well as on competitors.
- 9.44 Finally, it will be important to consider all of the above against the background of appropriate scenarios for the development of both 2G and 3G mobile services over a suitable time horizon, and to recognise the uncertainties involved in this analysis.

Question 9.5 – Do you have any views on how Ofcom should analyse the potential effects of liberalisation of the existing 2G bands? Which aspects of the analysis do you think will be particularly important?

Initial discussion of possible approaches

- 9.45 The discussion earlier in this Section has identified that there is a range of mechanisms for introducing liberalisation, including variations of existing licences, and issuing new licences with a different definition of the spectrum usage rights. It is also possible that there might be a variety of conditions precedent that need to be satisfied in order for liberalisation to occur.
- 9.46 Ofcom has given some initial thought to the range of options that might therefore be available for giving effect to liberalisation in the existing 2G bands. It may be helpful to respondents to list briefly the options that Ofcom has identified so far, though it should be stressed that this list is indicative only. No detailed analysis of the costs, benefits, risks, legal feasibility or relative attractiveness of these options has been undertaken. This will form part of the empirical analysis, including the contribution from external consultants, discussed above.
- 9.47 In taking this matter forward, Ofcom's objective will be to identify the course of action that offers the most proportionate mechanism to achieve the benefits sought by liberalisation. Given that the most appropriate option will depend on the effects of different approaches, detailed consultation on possible regulatory action is likely to be required after further analysis has been undertaken.
- 9.48 Ofcom would welcome any comments on the options listed, and on other approaches that might be taken to resolving the future of existing 2G spectrum, including any that might be achieved through non-regulatory means.

Option 1 – Defer the decision

- 9.49 Under this option Ofcom would not seek to make any decision in the near future in relation to the extension of liberalisation to the existing 2G bands, whether through the removal of restrictions on existing licensees or the issue of new licences.
- 9.50 This might be an appropriate course of action if the uncertainties in relation to the effects of liberalisation are great, if these uncertainties are likely to be diminished by time, and if the potential adverse effects of seeking a resolution outweigh the expected benefits. The probability that this is an appropriate course of action is likely to be increased if alternative uses of the 2G spectrum are unlikely to be a more efficient use of the spectrum for a long period. There may also be arguments in favour of this approach if international harmonisation obligations are likely to be a constraint in the long term.
- 9.51 There are also risks associated with this option. In particular, it may delay the benefits associated with liberalisation of 2G spectrum from being realised, if these would otherwise occur sooner. It may also create uncertainty for the mobile sector which may impair the ability of operators to plan efficiently. There may also be adverse effects on the efficiency of the award processes for the spectrum identified in Sections 4-6, consequent on additional uncertainty.

Option 2 – Extend liberalisation by removing restrictions on existing licensees' use of the 2G spectrum. Do so under none, one or several of various possible conditions

This option comprises a range of possible sub-options, under which liberalisation might proceed by removing restrictions on existing licensees' use of the spectrum, but this might occur under one or more of certain conditions, or alternatively none of these conditions.

Option 2(a) - Delay date of liberalisation of 2G spectrum

- 9.52 Under this option, liberalisation would be extended by removing restrictions on the existing licensees' use of 2G spectrum, but this removal would be delayed until a later date, such that the material adverse effect on competition (if any) is reduced or eliminated. Any adverse effect on competition might be reduced if, for example, additional spectrum became available in the interim and this was an effective substitute for the existing 2G bands.
- 9.53 The extent to which this option would be satisfactory is unclear because there is likely to be a positive correlation between the magnitude of any adverse effects on competition impacts and the magnitude of the economic benefits of liberalisation.
- 9.54 If the benefits of removing restrictions on existing licensees are expected to be small, then it might be considered that little would be lost by delaying liberalisation. However, any adverse effects on competition might also be small, in which case it might be argued that liberalisation should go ahead without delay. By contrast, if the benefits of liberalisation are expected to be large, then delay is also likely to be costly in terms of economic efficiency. The adverse effects on competition (if any) might however also be significant.

Option 2(b) - Levy an additional payment on the existing 2G licensees

- 9.55 Under this option any adverse effects on competition might be neutralised through an adjustment to AIP charge for the relevant spectrum.
- 9.56 Care would need to be taken to avoid poor incentive properties being created by an increase in AIP. There is an analogy in this connection with the inferior incentive properties of rate of return regulation compared to a price cap. If the increase in AIP were to occur, because a greater value for the spectrum had been revealed, the incentive on spectrum holders to realise the most valuable use might be reduced, because much or all of the gain would be taken away. But such disincentives might be avoided, if the increase in AIP were imposed in advance, eg based on an estimate or forecast, and not subsequently revised (or only after a significant time lag). A practical difficulty with this approach would be to estimate accurately the size of the additional payment.

Option 2(c) – Setting other pre-conditions or none

- 9.57 Another alternative might be to establish a set of pre-conditions which had to be satisfied before 2G spectrum could be liberalised. The intention would be, through the selection of the pre-conditions, to neutralise or diminish any adverse impact of liberalisation. Exactly what the pre-conditions would be can only be assessed when the cause of any adverse impact is understood. However, by way of example, if the concern were about the availability of sufficient spectrum to ensure no competitive advantage accrues to the existing 2G licensees, it might be appropriate to delay the removal of restrictions on the existing 2G bands until a similar (or greater) quantity of substitute spectrum was held in the market by third parties. Liberalisation might then proceed subject to payment of an adjusted AIP fee, based on the terms under which the substitute spectrum was awarded.
- 9.58 Dangers with this option include the potential for significant delay to the realisation of benefits from change of use of this spectrum, and the possibility for gaming of the process by various parties.
- 9.59 If however the removal of restrictions on the existing licensees is not likely to give rise to any material adverse on competition, and is clearly likely to benefit citizens and consumers, it may be appropriate to agree the removal of restrictions without further preconditions, other than those necessary to ensure compliance with international obligations, the avoidance of undue interference, and other constraints of law.

Option 3 – Extend liberalisation by issuing new licences that contain additional rights, and award these via an overlay auction.

- 9.60 A different approach would be to decide that in the particular circumstances of the existing 2G bands the most appropriate means of effecting liberalisation would be to issue new licences containing the rights to use this spectrum for purposes other than 2G. These new licences might then be made available through an overlay auction.
- 9.61 In an overlay auction, the existing users of the spectrum (ie the existing 2G licensees) would typically retain their licences to use the spectrum to provide 2G services. They would also continue to receive protection from interference for this purpose. The winners of the overlay auction would acquire licences giving them the ability to use the spectrum for purposes other than 2G, but they would not be able to make immediate use of these licences (for any purpose

that interfered with the provision of 2G services) unless they reached agreement with the incumbent 2G licensees.

- 9.62 The overlay auction would be open to the existing 2G licensees, and to other parties. A number of different approaches could be taken to the specification of the incumbent licensees' and auction winners' respective rights. A number of different approaches have, for example, been taken to the design of overlay auctions by the FCC.

Question 9.6 – Do you have any comments on the options for giving effect to liberalisation of the existing 2G spectrum?

Next steps

- 9.63 This section has set out an initial analysis of the issues relating to the extension of liberalisation to the existing 2G spectrum. Ofcom welcomes the views of respondents on the issues and questions identified. As explained above, in parallel to this consultation Ofcom will be conducting further economic analysis of the issue with the assistance of external consultants. The conclusions of that analysis will together with the responses to this consultation document form the basis for Ofcom's further consideration of the issue. Ofcom plans to give respondents an opportunity to comment on the findings of the economic study later in the year.

Extension of trading to existing 2G licences

- 9.64 In the Trading Consultation Document and Trading Statement Ofcom has explained why, as a matter of general policy, the extension of spectrum trading is beneficial to the efficient management of the spectrum.
- 9.65 The existing 2G licences have been identified in Section 7 of this document. In relation to these licences, as to a number of other licence classes, Ofcom considers that the extension of trading is likely in due course to bring benefits to citizens and consumers. However, Ofcom does not consider that the applicability of spectrum trading to the existing 2G licences can be separated from consideration of the applicability of liberalisation. The discussion in previous paragraphs has indicated a number of complications that arise in relation to the potential liberalisation of the existing 2G bands.
- 9.66 Ofcom's view is that further consideration of the extension of trading to the existing 2G bands should take place in parallel with further consideration of the issues connected to liberalisation. This is appropriate given that (as discussed in Section 3 and in the Trading Statement) the extension of trading to a licence class requires decisions to be made on a number of matters that could be relevant to the liberalisation issue, including potential licence modifications on matters such as term and notice periods.
- 9.67 Subject to a satisfactory resolution of the issues connected with the applicability of liberalisation, Ofcom would seek to extend trading to the existing 2G licences in 2007.

Extension of trading and liberalisation to existing 3G licences

- 9.68 The existing 3G licences have also been identified in Section 7 of this document. In relation to these licences, as to a number of other licence

classes, Ofcom considers that the extension of trading is likely in due course to bring benefits to citizens and consumers.

- 9.69 The term of the existing 3G licences runs to 31 December 2021. Ofcom has made clear (in the Trading Statement, paragraph 6.7) that it has no intention of changing the term of auctioned licences in connection with the introduction of trading.
- 9.70 Ofcom's view is that further consideration is required of the potential extension of liberalisation and trading to the existing 3G licences before decisions can be made. There may be aspects of this issue that need to be considered alongside the issues connected to the potential liberalisation of the 2G spectrum.
- 9.71 In relation to liberalisation in particular, Ofcom will also need to have careful regard to the constraints imposed by international harmonisation measures, including the UMTS decision discussed in Section 7. In relation to trading, Ofcom has already identified (as with the 2G licences) an intention to seek to extend trading to the 3G licences in 2007.
- 9.72 Ofcom will consider any request for variation to these or other licences on its merits at any time, in light of all relevant circumstances and Ofcom's statutory duties. Prior to extending trading to either 2G or 3G licences, Ofcom would, in line with its general approach set out in the Trading Statement, expect to undertake a review of any non-spectrum licence conditions.

Question 9.7 – Do you have any comments on the extension of trading to the existing 2G licences, or on the extension of trading and liberalisation to the existing 3G licences?

Section 10

3G Operators rollout obligations – draft guidance

10.1 This Section discusses the roll-out obligation in the licences held by the existing 3G operators. Its main purpose is to set out for consultation some draft guidance on how Ofcom is likely to approach the enforcement of this obligation if licensees do not comply.

Enforcement of the Roll-out Obligation

The need for guidance

10.2 Ofcom believes that it may be helpful to the 3G operators and more generally to investors in 3G services to provide some clarification on its likely approach to compliance with the roll-out obligations due to be fulfilled by the end of 2007.

10.3 Ofcom has been approached by a number of parties seeking such clarification. The issue has become more salient as the date for compliance becomes closer. Of course, it is not possible for Ofcom to specify in advance how it would treat any particular case, however it can provide some general guidance on the issue and this section sets out proposals for draft guidance on that.

Question 10.1 Do you agree that guidance from Ofcom on its approach to enforcement of the 3G roll out obligations would be helpful?

The rollout obligations

10.4 As explained in Section 7, following the auction in April 2000 five Wireless Telegraphy Act licences were granted for frequency assignments for 3G mobile telephony services to Vodafone, Orange, T-Mobile and O2 and H3G. These licences contained a condition which required the licensees to meet certain targets for the roll-out of their 3G networks. Specifically paragraph 4(a) of the Schedule to each licence provided:

“The Licensee shall install, maintain and use Radio Equipment (as specified in paragraph 10 of Schedule 1) in such a way as to enable the provision of, by not later than 31 December 2007, and to maintain thereafter, a telecommunications service by means of the Radio Equipment to an area where at least 80% of the population of the UK live.”

10.5 This is referred to as the “roll-out obligation”. The Information Memorandum at the time of the auction (paragraph 2.2.4) said that “the obligation reflects the need both to ensure the efficient use of the spectrum and provide a reasonable level of service to customers”.

Potential sanctions for non-compliance

10.6 As explained above, the roll-out obligation is a wireless telegraphy licence condition and therefore a breach is governed by the provisions relating to the breach of any other wireless telegraphy licence condition (see in particular,

section 1(1) of the Wireless Telegraphy Act 1949). Transmission by a licensee which is failing to comply with its roll-out obligation could in principle result in:

- prosecution for a criminal offence, with the licensee (and possibly in certain extreme cases (see section 404 of the Communications Act 2003) its directors) being liable (where the licensee had disregarded an Ofcom conformity notice requiring compliance) on summary conviction to a fine and/or a prison sentence; and / or
- revocation of the licence.

10.7 This sanction regime appears to have been designed primarily to deal with the enforcement of the spectrum licence conditions in Wireless Telegraphy Act licences which primarily address the technical engineering of a radio system. They are clearly less amenable to the enforcement of non-spectrum licence conditions such as a roll-out condition.

10.8 Revocation of the licence is an extremely serious measure to take. Licence fees, investment by an operator, and the existence of commitments to several third parties including contractors, equipment vendors and consumers would all need to be taken into account when assessing the proportionality of such proposed action. In particular, the implications for dependant customers would need to be assessed carefully including timescales to migrate to alternative suppliers, disruption to businesses and loss of facilities.

Ofcom's general approach to enforcing the obligations

10.9 Ofcom expects all licensees to meet the requirements for roll-out stated in their licences by the end of 2007. However, in the event that these were not achieved Ofcom sets out below some proposed draft guidance on its likely approach to dealing with such a situation.

10.10 Ofcom needs to consider any decision within the context of its legal obligations. In particular Ofcom would be required to act reasonably and to take all relevant considerations into account in relation to dealing with any non-compliance with the roll-out obligation.

10.11 Ofcom is already monitoring compliance with the obligations. The obligation is not due to be satisfied until the end of 2007 and therefore no sanction could be imposed before that date. However, Ofcom anticipates it will begin the formal process of assessing compliance towards the end of 2007 so that it would be in a position to make a decision on any non-compliance early in 2008.

10.12 Ofcom will carry out a detailed investigation into any non-compliance to assess both the magnitude of problem and the reasons why it has occurred. Such an investigation is likely to include an assessment of the following factors:

- any stated reasons for non-compliance of an operator with the 80% requirement in the roll out obligation;
- the extent of non-compliance and the anticipated timescale to remedy any deficiency;
- the number of subscribers of any non-compliant licensee;
- the compliance rates of other operators;
- the capital investment ratio of compliant / non-compliant licensees;

- the market environment pertaining at the time of investigation;;
- any technology issues that may be relevant, including their applicability to compliant / non-compliant operators respectively.

Ofcom's proposed draft guidance on enforcement action

10.13 As explained above, it is not possible for Ofcom to fetter its discretion regarding any future action it may take if a licensee does not comply with the roll out obligations. The appropriate action would need to be judged at the time in the light of all relevant considerations and circumstances. However, Ofcom considers that it may be helpful to issue some guidance as to the approach that it might take, and to consult on that guidance in draft.

10.14 The draft guidance is as follows.

10.15 Ofcom will need to assess whether a licensee has met the 80% of population coverage requirement. Ofcom is likely to make such an assessment by using the data provided by the 3G operators in their regular updates to Ofcom of their commissioned 3G base stations but subject to appropriate independent verification. Using this data, Ofcom will use its 3G planning tool and propagation model ITU-R PN.1546 to produce appropriate coverage plots which will be compared against a UK population database to estimate the percentage of population able to receive service.

10.16 As explained above there is a possibility of criminal sanctions for breach of a licence condition. However Ofcom considers that criminal sanctions may not be an appropriate means to secure the objectives which the roll out obligations were designed to achieve. It is also relevant that non compliance with roll out obligations would not involve harmful interference to other users of the radio spectrum: harmful interference is often the primary driver behind the application of criminal sanctions. In any event Ofcom is unable to prosecute for an offence relating to the contravention of terms of a wireless telegraphy licence until it has first served a conformity notice under section 172 of the Communications Act 2003. The notice must require the licensee to comply with the particular licence term or make representations about the matters notified, both within a specified period. Ofcom could not prosecute if a licensee complies or makes representations that convince Ofcom that prosecution is not appropriate.

10.17 Revocation of a 3G licence for non-compliance with the roll-out obligation would only appear to be proportionate in serious cases of non-compliance.

10.18 Such a serious case could exist if a licensee had not rolled-out a network to any significant extent, was making little use of the spectrum and had no significant subscriber base. By contrast, where a licensee had rolled out a network to a significant extent and could clearly demonstrate to Ofcom that they have evidence of a clear commitment to remedy the infringement of their roll-out licence condition in a timely way, Ofcom is likely to consider that revocation would be a disproportionate sanction to impose. That is particularly the case where an operator demonstrates that it has made substantive progress towards compliance and that it will be able to comply within a specified reasonable period.

10.19 In assessing the commitment of an operator to remedy a shortfall, Ofcom would expect to see evidence that the licensee would and could discharge the roll-out obligation in a timely manner. Appropriate evidence may include producing a

detailed programme for achieving compliance that has technical and financial approval at Board level with an appropriate timetable for reaching the required level of network coverage and including specific target steps to achieve compliance with an agreed schedule for monitoring performance. It may be appropriate for Ofcom to consider varying the licences of non-compliant licensees to reflect an agreed timetable for achieving compliance.

Question 10.2 What are your views on Ofcom's proposed guidance on enforcement action?

Section 11

Next Steps

11.1 This Section sets out the next steps in relation to the bands and policy issues discussed in this document.

Spectrum Awards

11.2 Sections 5 and 6 have set out Ofcom's plans for spectrum awards in a number of bands.

11.3 Tables 11.1 below sets out in summary form the next steps in relation to awards in bands up to 3GHz

Band	Proposal	Next Steps	Possible Award Date
Part of 174 – 230 MHz (Band III)	Possible award discussed in full in Radio – Preparing for the future (December 2004).	The band will taken forward in line with the proposals in Radio – Preparing for the future.	To be determined
410 – 425 MHz	Award on a service and technology neutral basis	Analyse business potential of the band and technologies that might be employed. Subject to the outcome of that analysis and the current consultation process, preparations will be made for the licence award in 2005/6. If the band is to be auctioned there will be prior consultation on draft Regulations and an Information Memorandum for the auction	2005/6
470 – 854 MHz	To await the outcome of RRC in 2006	Prepare the UK's position for the RRC	To be determined
870 – 921 MHz	As for 410 – 425 MHz	As for 410 – 425 MHz	2005/6
1452 - 1492 MHz (L Band)	Auction on a service and technology neutral basis.	Further analysis of the options and timing for an award in the light of responses to this consultation document. Further consultation is planned for 2005/6 to allow award in 2006/7.	2006/7
DECT guard bands (1781.7 – 1785 MHz paired with	Auction 3 – 6 concurrent low power licences.	Subject to the outcome of the current consultation process, and further analysis, preparations will be made for the licence award	2005/6

Band	Proposal	Next Steps	Possible Award Date
1876.7 – 1880 MHz)		probably in 2005/6, with the publication of draft Regulations and an Information Memorandum for the auction.	
1790 – 1798 MHz	Possible auction on services and technology neutral basis.	Further discussions with Government users to determine if an award can be made and by when, and in light of this further consultation is planned for 2005/6.	2007/8
2010 -2025 MHz	Auction on a service and technology neutral basis, subject to resolution of EU harmonisation issues.	Further discussions in Europe in early 2005 on harmonisation measures. In parallel analyse business potential of the band and technologies that might be employed. Subject to the outcome of that analysis, the current consultation process and EU process, preparations will be made for the licence award in 2005/6, with the publication of draft Regulations and an Information Memorandum for the auction.	2005/6
2290 – 2302 MHz	Auction on a service and technology neutral basis.	Preparations for an award to be made on same timing as 2010 – 2025 MHz band.	2005/6
2302 – 2310 MHz	As for 1790-1798 MHz.	As for 1790 1798 (see above)	2006/7
2500 – 2690 MHz	Auction on a service and technology neutral basis, subject to resolution of EU harmonisation issues.	Further discussions in Europe in 2005/06 on harmonisation measures. Further consultation planned for late 2005/6.	2006/7

11.4 Tables 11.2 below sets out in summary form the next steps in relation to awards in bands over 3GHz

Band	Proposal	Next Steps	Possible Award Date
3.6 – 4.2 GHz	Make more spectrum available for new services, taking account of the interests of	Clarify current usage of the band and explore regulatory position of receive only earth stations in light of responses to this consultation	To be determined.

	existing users of the band	document. Further consultation planned for 2005/06.	
10 GHz	Auction on a service and technology neutral basis	Agree with MoD the arrangements for civil use alongside continued military use. Subject to those discussions and responses to this consultation document, prepare to award the spectrum in 2006/7.	2006/7
28 GHz	Award remaining regional licences via an open-ended auction process	Subject to the outcome of the current consultation process, Ofcom's plan is to offer licences for award in, with the publication of draft Regulations and an Information Memorandum for the auction.	2005/6
32 GHz	Auction on a service and technology neutral basis	Consult CAA about its interests in the band. Subject to those discussions and responses to this consultation document, prepare to award the spectrum in 2006/7.	2006/7
40 GHz	Make more spectrum available for new services, taking account of the interests of existing users of the band	Subject to the outcome of the current consultation process, Ofcom's provisional plan is to design and consult on a licensing process to be opened by end of 2005/6.	2005/6

Mobile Policy Issues

11.5 Table 11.3 below sets out how Ofcom plans to take forward the various issues discussed in this document relating to mobile spectrum

Policy Issue	Proposal	Next Steps
Removal of restrictions in licences preventing the provision of mobile services other than 3G	In general to allow the removal of such restrictions, subject to legal constraints. Additional considerations are relevant to the 3.4 GHz licences.	Plan to publish a statement in light of responses to this consultation document in Summer 2005.
Removal of restrictions in licences preventing the provision of 3G mobile services	In general to allow the removal of restrictions, subject to legal constraints, but after a transitional period has elapsed, which may last	Plan to publish a statement in light of responses to this consultation document in Summer 2005.

	until 2007. (2G band is an exception to this - see below.)	
Introduction of spectrum trading for 2G	In principle to allow this subject to resolution of 2G liberalisation issue.	Plan to publish a statement at the same time as the statement of 2G liberalisation policy.
Introduction of spectrum trading for 3G	In principle to allow this subject to resolution of 2G liberalisation issue.	Plan to publish a statement at the same time as the statement of 2G liberalisation policy.
Liberalisation of 2G spectrum	To consider further the potential effects of liberalisation and to identify any appropriate remedies.	To conduct a detailed economic study and plan to publish the results for consultation in Spring 2005, and thereafter to issue a statement.
Liberalisation of 3G spectrum	To consider further alongside 2G liberalisation issue.	Plan to publish a statement at the same time as the statement of 2G liberalisation policy.
Enforcement of 3G roll out conditions	Issue draft guidance	Plan to publish final guidance in light of responses in Summer 2005.
Review of non-spectrum licence conditions in relation to mobile licences	Carry out a review before extending spectrum trading to these licences.	No immediate next steps required.

Section 12

Responding to this consultation

How to respond

- 12.1 Ofcom invites written views and comments on the issues raised in this document, to be made by 5.00 pm on 24 March 2005.
- 12.2 Ofcom strongly prefers to receive responses as e-mail attachments, in Microsoft Word format, as this helps us to process the responses quickly and efficiently. Please can you send your response to peter.bury@ofcom.org.uk
- 12.3 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

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Tel: 020 7783 4409
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- 12.4 Note that we do not need a hard copy in addition to an electronic version. Also note that Ofcom will not routinely acknowledge receipt of responses.
- 12.5 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex C. It would also help if you can explain why you hold your views, and how Ofcom's proposals would impact you.

Further information

- 12.6 If you have any questions about the issues raised in this consultation, or need advice on the appropriate form of response, please contact Peter Bury on 020 7783 4409.

Confidentiality

- 12.7 Ofcom thinks it is important for everyone interested in an issue to see the views expressed by other consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, as soon as possible after the consultation period has ended.
- 12.8 All comments will be treated as non-confidential unless respondents specify that part or all of the response is confidential and should not be disclosed. Please can you place any confidential parts of a response in a separate annex, so that non-confidential parts may be published along with the respondent's identity.

12.9 We would be grateful if you could speed up our response-handling processes by completing a response cover sheet (see Annex C) to indicate whether or not there are confidentiality issues. The cover sheet can be downloaded from Ofcom's website from the page where this consultation document appears.

12.10 Please also note that copyright in responses will be assumed to be relinquished unless specifically retained.

Next steps

12.11 These have been set out in Section 11.

12.12 Please note that you can register to get automatic notifications of when Ofcom documents are published, at http://www.ofcom.org.uk/static/subscribe/select_list.htm.

Ofcom's consultation processes

12.13 Ofcom is keen to make responding to consultations easy, and has published some consultation principles (see Annex A) which it seeks to follow, including on the length of consultations.

Complex consultations

12.14 Ofcom will generally allow 10 weeks for complicated policy issues. This is slightly shorter than the Cabinet Office guidelines on consultation (12 weeks). But Ofcom thinks this is appropriate given the speed with which the communications industry changes. Ofcom will also aim to speak informally to a number of people and organisations before the 10-week period to test our thinking and to listen to their thoughts.

Shorter consultations

12.15 Some formal consultations will need to be shorter than 10 weeks. In those cases Ofcom will usually aim to allow five weeks. However, the time may vary depending on the issue. Consultations may be shorter than 10 weeks if:

- the issue or community involved is small or only affects a particular group, which has been identified ahead of time;
- a proposal will have a limited effect on a market;
- a proposal is only a limited amendment to existing policy; or
- an issue needs to be looked at urgently.

12.16 We may also run a shorter formal consultation process if:

- the law says Ofcom must act within a specific time period;
- the organisations involved in a specific consultation agree they want a faster timetable; or
- this is the second consultation on the same issue.

12.17 In this instance Ofcom has adopted a five week consultation period because the proposal is a limited amendment to existing policy, and the proposals set out in the consultation need to be implemented urgently.

12.18 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk. We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, whose views are less likely to be obtained in a formal consultation.

12.19 If you would like to discuss these issues, you can alternatively contact Philip Rutnam, Partner, Competition and Strategic Resources, who is Ofcom's consultation champion:

Philip Rutnam
Ofcom
Riverside House
2A Southwark Bridge Road
London SE1 9HA

Tel: 020 7981 3585
Fax: 020 7981 3333
E-mail: philip.rutnam@ofcom.org.uk

Annex A

Ofcom's consultation principles

- A.1 Ofcom has published the following seven principles that it will follow for each written consultation:

Before the consultation

- A.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

During the consultation

- A.3 We will be clear about who we are consulting, why, on what questions and for how long.
- A.4 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened version for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.
- A.5 We will normally allow 10 weeks for responses, other than on dispute resolution.
- A.6 There will be a person within Ofcom who will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. This individual (who we call the consultation champion) will also be the main person to contact with views on the way we run our consultations.
- A.7 If we are not able to follow one of these principles, we will explain why. This may be because a particular issue is urgent. If we need to reduce the amount of time we have set aside for a consultation, we will let those concerned know beforehand that this is a 'red flag consultation' which needs their urgent attention.

After the consultation

- A.8 We will look at each response carefully and with an open mind. We will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

Annex B

Consultation response cover sheet

- B.1 In the interests of transparency, we will publish all consultation responses in full on our website, www.ofcom.org.uk, unless a respondent specifies that all or part of their response is confidential. We will also refer to the contents of a response when explaining our decision, unless we are asked not to.
- B.2 We have produced a cover sheet for responses (see below) and would be very grateful if you could send one with your response. This will speed up our processing of responses, and help to maintain confidentiality by allowing you to state very clearly what you don't want to be published. We will keep your completed cover sheets confidential.
- B.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to confirm on the response cover sheet that Ofcom can publish their responses upon receipt.
- B.4 We strongly prefer to receive responses in the form of a Microsoft Word attachment to an email. Our website therefore includes an electronic copy of this cover sheet, which you can download from the 'Consultations' section of our website.
- B.5 Please put any confidential parts of your response in a separate annex to your response, so that they are clearly identified. This can include information such as your personal background and experience. If you want your name, contact details, or job title to remain confidential, please provide them in your cover sheet only so that we don't have to edit your response.

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

What do you want Ofcom to keep confidential?

- | | | | |
|----------------------|--------------------------|---|--------------------------|
| Nothing | <input type="checkbox"/> | Name/contact details/
job title | <input type="checkbox"/> |
| Whole response | <input type="checkbox"/> | Organisation | <input type="checkbox"/> |
| Part of the response | <input type="checkbox"/> | If there is no separate annex, which parts? | |

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

- | | | | |
|-----|--------------------------|----|--------------------------|
| Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
|-----|--------------------------|----|--------------------------|

Annex C

Consultation questions

Policy on release of spectrum

Question 4.1 Do you see scope for using simpler auction formats in the future than used in the UK in the past?

Question 4.2 Do you agree future auctioned licences be for a minimum fixed term with a rolling extension?

Question 4.3 If licences with minimum fixed terms followed by rolling terms are introduced, do you agree that AIP should be payable during the rolling term of a licence?

Question 4.4 What should Ofcom do to ensure that bidders are well informed and well prepared to participate in an auction?

Question 4.5 Do you agree these are relevant considerations which Ofcom should take into account in devising its programme of spectrum awards?

Question 4.6 Do you believe that the proposed award programme is appropriate?

Part of VHF Band III (174 – 230 MHz)

Question 5.1 Do you agree with these proposals for the award of Band III?

Part of 410 – 425 MHz (410 -415 MHz paired with 420-425 MHz)

Question 5.2 Do you agree Ofcom should award a national licence on a technology and service neutral basis by auction or is there another option for award that is more likely to meet users' requirements?

Question 5.3 Do you think that spectrum in the band should be allocated for emergency services and business radio use?

470 – 854 MHz Broadcast Dividend

Question 5.4 Do you believe it is appropriate to wait until after the RRC in 2006 before developing policy proposals?

872 – 876 MHz paired with 917-921 MHz

Question 5.5 Do you agree Ofcom should award a UK licence on a technology and service neutral basis by auction?

L-Band (1452 -1492 MHz)

Question 5.6 Do you think Ofcom's proposal is appropriate?

1781.7 – 1785 MHz paired with 1876.7 – 1880 MHz (GSM/DECT Guard Bands)

Question 5.7 Is the award of a small number of concurrent UK low power licences (on the basis described) the right approach?

Question 5.8 What, in your opinion is the optimum number of low power licences?

1790 – 1798 MHz

Question 5.9 Do you believe the release of this band is a priority?

2010 – 2025 MHz

Question 5.10 Is a technology neutral UK licence or licences the right approach?

Question 5.11 Do you think it useful to run the awards for 2010 – 2025 MHz and 2290 – 2302 MHz bands at the same time to facilitate the option of creating potential FDD pairings? How important do you think this is, compared to say the risk of extra complexity?

Question 5.12 Do you have any comments on how the auctions might be linked?

2290 – 2302 MHz

Question 5.13 Is a technology neutral UK licence or licences the right approach?

Question 5.14 Do you think it useful to run the awards for 2010 – 2025 MHz and 2290 – 2302 MHz bands at the same time to facilitate the option of creating potential FDD pairings? How important do you think this is, compared to say the risk of extra complexity?

Question 5.15 Do you have any comments on how the auctions might be linked?

2500 – 2690 MHz

Question 5.16 Is a technology neutral award the right approach for the award of 2500 – 2690 MHz?

Question 5.17 Do you consider an auction in 2006/7 appropriate?

Question 5.18 Do you have any views on the relevance of encouraging new entry through the auction design, and if so how this might be effected?

Question 5.19 What do you consider is the right approach to packaging this spectrum?

3.6 – 4.2 GHz (3695-3875 MHz paired with 4015 – 4195 MHz)

Question 6.1 Do you agree that the band should be open for further terrestrial applications once Ofcom has clarified and regularised current usage in the band?

10 GHz (10.125-10.225 GHz paired with 10.475 – 10.575 MHz)

Question 6.2 Do you agree with the proposal to award a single UK licence on a service and technology neutral basis?

28 GHz (28.0525 to 29.4525 GHz)

Question 6.3 Do you agree with the proposal to open an award process for the remaining regional licences on the lines suggested?

32 GHz Band (31.8 – 33.1 GHz)

Question 6.4 Do you agree with the proposal to award one or more UK licences on a service and technology neutral basis?

Question 6.5 How many licences should be offered?

Question 6.6 Do you agree that the award process should be on the lines proposed?

40 GHz (40.5 to 43.5 GHz)

Question 6.7 Do you agree with the proposal to license part of the 40 GHz band to encourage its use for the development of innovative services and technologies?

Question 6.8 How much of the band should be opened for this purposes and what technical conditions should be imposed?

Question 6.9 Within what timescale should this licensing process be opened, in particular is the suggestion of the end of 2005/06 appropriate?

Question 6.10 Do you agree that point to point links should be licensed in part of this band on a location specific assigned basis, in the same way the existing point to point bands are licensed. If so how much spectrum do you consider would be appropriate for this?

Removing restrictions on the use of spectrum for mobile services

Question 8.1 Do you have any views on the approach that Ofcom should take to restrictions that prevent the use of spectrum for mobile services other than 3G?

Question 8.2 Do you have a view on whether Ofcom should impose restrictions on new spectrum licences to prevent use of the spectrum for mobile services other than 3G?

Question 8.3 Do you agree that it may be appropriate to allow a period of time to elapse following an auction before extending liberalisation to auctioned licences, through the removal of restrictions as to type of use and technology? Please comment on this issue either as a general matter, or in relation to particular classes of auctioned licences, such as the 3.4 Ghz licences, or both.

Question 8.4 If your answer to question 8.3 is affirmative, do you have a view on the period that might be allowed to elapse before removing restrictions on the 3.4 Ghz licences? We would also be interested in your views on whether we need to seek to resolve this issue at any particular time.

Question 8.5 Do you consider that the criteria used above are the most relevant considerations in relation to the potential removal of restrictions on offering 3G mobile services? Do you have any views on the approach that Ofcom should take towards removing restrictions in existing spectrum licences that prevent use of the spectrum to provide 3G mobile services? Which of options 1-4 above do you think offers an appropriate balance between those considerations that are relevant?

Question 8.6 Do you consider that the criteria used above are the most relevant considerations in relation to the application of liberalisation to the award of new licences and the opportunity to offer 3G services?

Question 8.7 Ofcom seeks views from interested parties on the approach that it should take to the award of new licences (other than in the 2010-2025 MHz and 2500-2690 MHz bands), and whether these should contain any restrictions as to use of the spectrum to offer 3G services. Do you have any views on which of the options discussed offers the most appropriate balance between relevant considerations?

Question 8.8 Do you have a view on whether it is useful to have a working definition of the term “3G services”? If so, do you agree with the definition set out for illustrative purposes above?

Trading and liberalisation in existing 2G and 3G bands

Question 9.1 Do you have a view on the appropriate timing for seeking to resolve the issues discussed in this Section?

Question 9.2 Do you consider that there should, in principle, be benefits from extending liberalisation to the spectrum presently used for 2G services, so that there is greater flexibility for the market to determine optimum use?

Question 9.3 Do you have any comments on the significance of the constraints on liberalisation of 2G spectrum that are likely to flow from (a) technical constraints, to avoid undue interference, or (b) international obligations? What approach should Ofcom take to the liberalisation of the 2G spectrum, given the international obligations? And what approach should Ofcom take to those harmonisation measures that are relevant to the existing 2G spectrum?

Question 9.4 In your view, how relevant is the structure of competition in 3G services established by the 3G auction to considering the potential extension of liberalisation to the existing 2G bands?

Question 9.5 – Do you have any views on how Ofcom should analyse the potential effects of liberalisation of the existing 2G bands? Which aspects of the analysis do you think will be particularly important?

Question 9.6 – Do you have any comments on the options for giving effect to liberalisation of the existing 2G spectrum?

Question 9.7 – Do you have any comments on the extension of trading to the existing 2G licences, or on the extension of trading and liberalisation to the existing 3G licences?

3G Operators roll out obligations – draft guidance

Question 10.1 Do you agree that guidance from Ofcom on its approach to enforcement of the 3G roll out obligations would be helpful?

Question 10.2 What are your views on Ofcom’s proposed guidance on enforcement action?

Annex D

Summary of responses

D.1 This annex sets out a summary of responses made to the Trading Consultation Document and Liberalisation Consultation Document which are relevant to the issues of the extension of trading and liberalisation to spectrum used for mobile services discussed in Sections 8 and 9.

Responses to Trading Consultation Document

D.2 In the Trading Consultation Document Ofcom noted the desirability of introducing spectrum trading in 2G and 3G simultaneously, in order to prevent distortion in the cellular telephony industry. In addition Ofcom also noted its belief that it would be inappropriate to introduce trading prior to resolving issues relating to 2G spectrum re-farming and identification of potential 3G expansion bands have been resolved, internationally and within the EU. For these reasons Ofcom set out its proposal that spectrum trading of cellular licences should not commence before the end of 2007. It also set out the view that Ofcom would not expect to allow other bands not presently designated for 3G to change their use to offer 3G services until the end of the transition to full liberalisation and tradability in 2007.

D.3 Ofcom received a number of responses in relation to these issues. In general respondents were supportive of the proposals as set out by Ofcom, only one of the respondents (Nokia) to the consultation disagreed. Table D.1 below sets out the specific issues raised and Ofcom's responses.

Issue raised	Comments	Ofcom's response
Linking the timing of trading and liberalisation	<p>O2 and Orange however, suggested that trading may be implemented sooner if it were introduced in the absence of full liberalisation. It was suggested that this might be achievable in 2005. The outstanding issues on liberalisation could be resolved to a separate timetable, with liberalisation introduced in 2007/08.</p> <p>Vodafone and BT suggest that rather than separating the two concepts of trading and liberalisation, Ofcom should monitor developments and review its timetable for introduction in 2005.</p>	<p>Ofcom remains of the view that linking the timing of the introduction of trading to the resolution of the issues surrounding the liberalisation of 2G bands is the most appropriate way forward. Introducing trading of 2G licences before then is unlikely to be beneficial as there would be too much uncertainty regarding the scope of the rights. Furthermore, while the introduction of trading of 3G licences might be feasible before then, Ofcom remains concerned that different timing for the introduction trading between different classes of cellular licences might have unanticipated effects, and that it is more appropriate to consider the trading and liberalisation issues together.</p> <p>This document set outs Ofcom's current plans for extending trading and liberalisation to spectrum used for mobile services. It will review this in the light of the responses to the consultation document.</p>

Timing of trading	<p>Orange argued that the proposed moratorium on trading until 2007 constituted an artificial barrier to trading.</p> <p>A number of other respondents UK Broadband, IEE, Ericsson and two other respondents argued that, subject to resolution of outstanding issues, it may be possible to introduce trading sooner than 2007.</p>	<p>As explained above, Ofcom believes there are sound reasons for delaying the introduction of trading in 2007 and it remains of the view that given the nature of the issues which need to be resolved it is unlikely this would be done in time to introduce trading any earlier, but it will keep the matter under review, not least in light of this consultation.</p>
Need for a framework for the issues	<p>Several respondents Orange, Vodafone, BT and one other respondent also suggested that Ofcom identify a clear framework for resolving the outstanding issues relevant for the introduction of liberalisation and achieving full implementation of trading and liberalisation in this area.</p>	<p>Ofcom agrees with these comments and that is one of the objectives of this consultation document.</p>
International issues	<p>Two respondents IEE and Ericsson also noted the important role in international coordination that the introduction of liberalisation in these bands requires Ofcom to play, noting that the timetable for implementation must take account of this.</p>	<p>Ofcom acknowledges this issue, and as explained in Sections 7, 8 and 9 above, its ability to liberalise bands is subject to international harmonisation rules. It will take part in future international discussions relating to these issues and will seek to ensure a technology neutral approach which will facilitate the introduction of liberalisation.</p>

Responses to Liberalisation Consultation Document

- D.4 The Liberalisation Consultation Document did not specifically discuss the extension of liberalisation to spectrum used for mobile services. Some respondents commented on the absence of this discussion and commented that there was need for Ofcom to consult fully on its plans for the introduction of liberalisation to 2G and 3G.
- D.5 As set out above, this document forms the initial stage of consultation on Ofcom's policies and proposals for the introduction of trading and liberalisation in 2G and 3G spectrum. Ofcom has taken account of the responses to the previous consultation on trading relevant to 2G and 3G spectrum, in developing its proposals set out in this document. Ofcom will consider any comments made on these issue in response to the Liberalisation Consultation Document alongside responses to this document.

Annex E

Regulatory impact assessments

E.1 This Annex sets out some RIAs for certain proposals in the Consultation Document. The RIAs for other issues are set out in the relevant Sections above, in particular the RIA for the removal of restrictions on the use of spectrum for 3G services is set out in Section 8, at paragraphs 8.52 – 8.64 in particular.

410-415/420425 MHz

E.2 Ofcom has considered six main options for making the spectrum available for future civil use in this band, as described in Section 5 above. The economic benefits and costs, and the risks associated with each are discussed in the table below. The degree to which the economic benefits and costs can be qualified is limited because they depend on the level of demand and its geographic distribution, both of which are uncertain. The assessment therefore must take into account how different options perform according to different demand conditions.

Option	Benefits	Costs	Risks
Regional licence	Operators which only want to operate in one area or region can bid for that region, and if the most efficient use of the spectrum is regional, the spectrum will quickly be allocated to its most valuable use.	A regional auction may be more complex and costly than a national auction. Intensive spectrum use in one region e.g. London, may limit the economic benefits that can be generated in other regions because there is an overall national limit on interference that must be maintained	The value of the spectrum could be greater for a national licensee. (Also the specification of the regions may not meet the market's needs.) Tradability mitigates this risk by allowing the licences to be amalgamated post award. However, the larger the number of licences, the higher transaction costs, and the greater the disincentive to trade.
National licence	A national auction should be cheaper and simpler than a regional one. If there is a viable national use and it is the highest value use of the spectrum, the spectrum will flow immediately to this use. The costs of coordination with the military are likely to be lower.	If greater value can be generated by reallocating some of the spectrum to regional users, some efficiency will be lost during the transition. This transition may take time because substantial investment will be required to start a new national business the viability of which will not be immediately apparent.	The value of the spectrum may be higher to a group of regional users which were unable to come together to bid for the spectrum because of coordination problems. This risk is mitigated by the tradability of the spectrum and the ability for regional users to buy part of the spectrum post auction from the national licensee.

Reserve spectrum for business radio use	<p>This option can be incremental to either national or regional licensing.</p> <p>Reserving spectrum would grant on-site users rapid access to the spectrum for digital use. Otherwise, access to the spectrum would be delayed.</p>	<p>Some efficiency could be sacrificed by reserving this portion of the spectrum. It would be more efficient were users with on-site requirements either to bid jointly for spectrum, buy services from the winning bidder(s) or trade with the winner of the auction after it had been concluded.</p>	<p>As above the value of the spectrum may be higher to other users and trading can help mitigate this, but transaction costs would be incurred which might limit the degree to which trading would occur.</p>
Consider as part of wider UHF review	<p>Because the UHF 2 spectrum is a close substitute, it will affect the value of UHF1 spectrum. There may be potential efficiency gains in planning the award of spectrum in this band to take account of developments in the UHF2 band.</p>	<p>A market led realignment of the UHF2 spectrum could take considerable time, and opportunities could be lost if the award of UHF1 spectrum were constrained by this.</p>	<p>Considerable uncertainty may persist in the future development of spectrum use in UHF2. Intervention could help mitigate this risk, but this would not be in line with Ofcom's new approach to spectrum management.</p>
License on a first come first served basis	<p>There are diverse potential uses of the band. They are likely to be established in small localities or wider areas, but not nationally. Licensing on a first come first served basis, without pre-determining licenceable areas, would allow users to obtain spectrum to meet their particular requirements, subject to availability in their chosen area and the possibility of co-ordination with other band users.</p>	<p>A licensing system would be required for a considerable time, while spectrum was still available for award. This could require considerable administrative resources. The need for co-ordination between users would also require substantial technical input. A multiplicity of users would make co-ordination with military use more onerous.</p>	<p>There would be some danger of spectrum being assigned to users who are not best placed to make optimal use of the available spectrum, for the economic benefit of the UK. Trading can help mitigate this, but transaction costs would be incurred which might limit the degree to which trading would occur.</p>
Award the spectrum to a band manager	<p>A band manager would be able to allot spectrum to users in the light of its perception of market demands. It would also be free to develop innovative ways of assigning the spectrum. This could lead to a flexible and dynamic management regime that made optimal use of the available spectrum.</p>	<p>Considerable work would be required to define the band manager's role, obligations and rights and to establish the framework within which it would operate. Licensees would have to meet the band manager's costs.</p>	<p>There is only limited experience within the UK of band managers - in the specialised areas of programme making and public utilities. The role of band manager envisaged would be a new departure from past practice and would need to be carefully thought out to ensure spectrum users' interests were served. A band manager might</p>

have some market power if users had limited access to alternative spectrum. The release of spectrum would be delayed if, despite extensive preparatory work, a band manager could not be established.

E.3 The initial conclusion of this assessment is that the option which appears to perform best given the uncertainty over end-user demand and the demand for the spectrum is to award a national licence, but Ofcom will undertake a more detailed assessment of the options in the light of external consultants' market and technological analysis.

872-876/917-921 MHz

E.4 As with the 410-415/420425 MHz band, the degree to which the economic benefits and costs can be qualified is limited because demand is uncertain. The assessment therefore must take into account how different options perform according to different demand conditions.

Option	Benefits	Costs	Risks
Regional licence	Operators which only want to operate in one area or region can bid for that region Operators which only want to operate in one area or region can bid for that region, and if the most efficient use of the spectrum is regional, the spectrum will quickly be allocated to its most valuable use.	A regional auction may be more complex and costly than a national auction.	The value of the spectrum could be greater for a national licensee. (Also the specification of the regions may not meet the market's needs.) Tradability mitigates this risk by allowing the licences to be amalgamated post award. However, the larger the number of licences, the higher transaction costs and the greater the disincentive to trade.
National licence	The auction should be cheaper and simpler than a regional one. If there is a viable national use and it is the highest value use of the spectrum, the spectrum will flow immediately to this use.	If greater value can be generated by reallocating some of the spectrum to regional users, some efficiency will be lost during the transition. This transition may take time because substantial investment will be required to start a new national business the viability of which will not be immediately apparent.	The value of the spectrum may be higher to a group of regional users which were unable to come together to bid for the spectrum because of coordination problems. This risk is mitigated by the tradability of the spectrum and the ability for regional users to buy part of the spectrum post auction from the national licensee.

E.5 The level of uncertainty over market demand is such that it is impossible to be conclusive about which option would produce the greater net economic benefit. In this case, the impact assessment rests on the balance of risks and the extent to which they can be mitigated in each of the options. Under these conditions, the option to allocate the spectrum initially to a national

licence performs better because, if this allocation were sub-optimal, it is more likely that a more efficient outcome occurs than if the spectrum is initially allocated to regional licences.

1781-1785/1876-1881 MHz DECT Guard Band

E.6 An economic analysis of the potential economic benefits of the spectrum in different uses has been carried out by NERA and this work is not repeated here. The conclusions on the NERA study depended heavily on the probabilities of their demand projections. The level of market uncertainty prevented any meaningful calculation of these probabilities, therefore the table below discusses the potential economic benefits and costs in conjunction with the risks of each option in order to assess their impact.

Option	Benefits	Costs	Risks
Leave spectrum unassigned to assist migration to future 3G services.	<p>The costs of awarding and managing the spectrum would be avoided.</p> <p>If the spectrum were potentially needed at some point in the future for 3G spectrum, there would be no costs for clearing the spectrum.</p>	Potentially large benefits that could arise from using the spectrum would be foregone.	Many alternative sources of spectrum for 3G services are becoming available and there is a risk that this spectrum may never be needed to support 3G services.
Licence exemption	<p>Administrative costs would be few.</p> <p>Notwithstanding potential interference, many service providers could exploit the spectrum and innovative uses might develop.</p>	The high probability of interference is likely to depress significantly the value that can be generated from licence exempt use of this spectrum.	The risk of interference is high. Coordination between licensee could mitigate interference but would only be effective where the number of users is relatively small.
Wide area, high power use	An existing wide area cellular operator will benefit from using the spectrum to relieve congestion, saving costs and/or increasing quality of service.	The outcome may not be efficient because potential low power service providers may not have the resources to buy the spectrum individually. There may also be coordination problems in setting up consortia to buy the spectrum jointly for low power service providers.	There is a risk that a wide area user would have an incentive to hoard spectrum anti-competitively, even though trading some of the spectrum to a low power user would increase overall welfare.
Low power use - limited number of licences	A limited number of licensees will be able to use the spectrum to provide innovative services and exploit market niches in the mobile communications market.	The initial outcome may be inefficient. If high power use is after all most efficient, but some low power users have overestimated their potential	There is a risk that if low power use does not have the anticipated success, a high power user might be deterred by transaction costs from buying the

	market, it may not be possible for a wide range of service providers to win all the lower power licences in order to convert them to high power.	spectrum. This can be mitigated by limiting the number of lower power licences awarded and allowing consolidation.
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E.7 In conclusion, there seems little to choose between the options of wide area use and low power use if the direct economic benefits are considered. To the extent that market failures do not occur, trading should be able to resolve any inefficiencies in the spectrum allocation in each case. The low power use option does potentially bring the benefits of innovation, although these are typically difficult to quantify. If innovation in spectrum use has a high priority for policy makers, then this would tip the balance in favour of the option for low power use.

2010 – 2025 MHz

E.8 The table below gives an initial regulatory impact assessment of the options for assigning the spectrum in the 2010 - 2025 MHz band. The options are predicated on the assumption that the European harmonisation measures which currently apply to this band will be amended as necessary.

Option	Benefits	Costs	Risks
Maintain designation for licence exempt IMT-2000 TDD systems	The benefit that could be expected is very small because the probability that demand for licence exempt IMT-2000 services will develop is very low and, were it to happen, it could be many years in the future.	There is potentially a large economic cost from foregoing the benefits that could arise from letting the spectrum be exploited now for services which currently need the spectrum.	There is a (minor) risk that demand for licence exempt IMT-2000 services does develop in the future and that either new spectrum will have to be found or existing users more if harmonisation is important.
Multiple licences split by frequency	The benefit will be larger if the most efficient use of the spectrum is geared towards small users, there will be an economic benefit because small users will find it easier to enter the market.	Coordination costs will be higher the greater the number of licensees and the costs of amalgamating licences, were it economically efficient to do so, would be higher.	Licences may be unable to provide viable services in competition with existing service providers, if the band is split into parts.
Regional licences	Operators which only want to operate in one area or region can bid for that region, and if the most efficient use of the spectrum is regional, the spectrum will quickly be allocated to its most valuable use.	A regional auction may be more complex and costly than a national auction. Co-ordination with neighbours along regional boundaries could waste a significant amount of spectrum and limit	The value of the spectrum could be greater for a national licensee. (Also the specification of the regions may not meet the market's needs.) Tradability mitigates this risk by allowing the licences to be amalgamated

		the viability of service provision along these boundaries.	post award. However, the larger the number of licences, the higher transaction costs and the greater the disincentive to trade.
National licences	<p>The auction should be cheaper and simpler than a regional one.</p> <p>If there is a viable national use and it is the highest value use of the spectrum, the spectrum will flow immediately to this use.</p> <p>Operators who would like to deploy a technology that requires paired spectrum may find it easier to acquire such a pairing if licences are made available on a national basis.</p>	<p>If greater value can be generated by reallocating some of the spectrum to regional users, some efficiency will be lost during the transition. This transition may take time because substantial investment will be required to start a new national business the viability of which will not be immediately apparent.</p>	<p>The value of the spectrum may be higher to a group of regional users which were unable to come together to bid for the spectrum because of coordination problems. This risk is mitigated by the tradability of the spectrum and the ability for regional users to buy part of the spectrum post auction from the national licensee.</p>

E.9 Provided that the European constraints on the use of this band are lifted, the analysis indicates that a significantly better outcome would arise from not restricting the potential use of the spectrum to licence exempt IMT-2000 TDD services. The net benefits of the remaining options are inconclusive and depend on the likely demand for the spectrum. An analysis of the potential risks indicates that it may be better to licence the spectrum on a national basis and not to split by frequency. However, a detailed assessment of the demand for the spectrum would provide a more robust basis for decision. There may also be a benefit from awarding the spectrum at the same time as a similar band such as 2290 – 2302 MHz to facilitate operators acquiring paired spectrum if this the most efficient use.

2290 - 2302 MHz

E.10 The options for assessing the 2290 - 2302 MHz are very similar to those for the 2010 - 2025 MHz band. This should be expected given that the bands are close in frequency and have similar potential uses. For completeness the relevant options and their assessment are repeated below.

Option	Benefits	Costs	Risks
Multiple licences split by frequency	The benefit will be larger if the most efficient use of the spectrum is geared towards small users, there will be an	Coordination costs will be higher the greater the number of licensees and the costs of amalgamating	Licences may be unable to provide viable services in competition with existing service providers, if the band

	economic benefit because small users will find it easier to enter the market.	licences, were it economically efficient to do so, would be higher.	is split into parts.
Regional licences	Operators which only want to operate in one area or region can bid for that region, and if the most efficient use of the spectrum is regional, the spectrum will quickly be allocated to its most valuable use.	A regional auction may be more complex and costly than a national auction. Co-ordination with neighbours along regional boundaries could waste a significant amount of spectrum and limit the viability of service provision along these boundaries.	The value of the spectrum could be greater for a national licensee. (Also the specification of the regions may not meet the market's needs.) Tradability mitigates this risk by allowing the licences to be amalgamated post award. However, the larger the number of licences, the higher transaction costs and the greater the disincentive to trade.
National licences	The auction should be cheaper and simpler than a regional one. If there is a viable national use and it is the highest value use of the spectrum, the spectrum will flow immediately to this use. Operators who would like to deploy a technology that requires paired spectrum may find it easier to acquire such a pairing if licences are made available on a national basis.	If greater value can be generated by reallocating some of the spectrum to regional users, some efficiency will be lost during the transition. This transition may take time because substantial investment will be required to start a new national business the viability of which will not be immediately apparent.	The value of the spectrum may be higher to a group of regional users which were unable to come together to bid for the spectrum because of coordination problems. This risk is mitigated by the tradability of the spectrum and the ability for regional users to buy part of the spectrum post auction from the national licensee.

E.11 As for the 2010 - 2025 MHz band, it is difficult to state unequivocally which is the best option, or combination of options. The risk assessment indicates that it may be better to licence the spectrum on a national basis and not to split by frequency, however, a detailed assessment of the demand for the spectrum would provide a more robust basis for decision. There may also be a benefit from awarding the spectrum at the same time as a similar band such as 2290 – 2302 MHz to facilitate operators acquiring paired spectrum if this the most efficient use.

10 GHz (10.125-10.225 GHz paired with 10.475- 10.575 MHz)

E.12 The options for future use of the 10 GHz band are considered below. The two main options concern whether the band, which is managed by the MoD, should be open to civil use or not. The question of how civil licences should be awarded (regional or national) is also considered.

Option	Benefits	Costs	Risks
Exclude further civil use	The costs to the MoD of coordinating civil and military use will be avoided.	The potential economic benefits that a variety of civil uses could generate will be foregone.	
Allocate for civil use	A variety of services could make use of this spectrum, and constraints need to allow coordination with military use are not expected to be onerous.	The costs of coordinating civil and military use will be borne by the MoD and civil users (in the form of constraints on their spectrum usage)	In the past coordination agreements were struck, though it is possible that coordinating new civil uses with military use may be more difficult.
Award as a single national package	This option ensures maximum flexibility for operators, and minimise the costs of the award process. If the best use of the spectrum is with a single national licensee, then the full benefits are achieved most quickly.	If more economic value could be generated by dividing the spectrum amongst a number of users, transaction costs would be incurred in partitioning the licence.	If spectrum trading is working smoothly, the risk that a possible re-allocation of the spectrum could take time thus increasing potential losses in efficiency, will be low.

E.13 The initial assessment indicates that the benefits of allocating the spectrum to civil use are likely to substantially outweigh those of excluding further civil use of the spectrum. The risks of awarding the spectrum as a single national package appear to be manageable, however, further information on the potential demand would allow for a better assessment.

28 GHz (28.0525 to 29.4525 GHz)

E.14 A succession of economic assessments of options for allocating the 28 GHz band have been carried out in recent years, beginning with the auction of regional FWA licences in November 2000. This impact assessment draws from those previous analyses and assess a the options which are currently considered appropriate for the future use of the remaining unallocated spectrum in this band.

Option	Benefits	Costs	Risks
Delay or abandon further licensing	Further spending is avoided on awarding spectrum for which demand has proved uncertain in the past	Potential economic benefits from exploiting the spectrum would be delayed or foregone.	Innovation in the uses of the spectrum may be prevented or deterred if the opportunity to bid for the spectrum is denied.

Exempt from licensing	Ofcom would be able to dispense with licensing, this saving administrative costs.	The potential for interference between users is significant and would impose high costs on users.	Equipment for the band is expensive and the inability to guarantee the level of service could undermine operators' willingness to invest in the band.
Licence base stations	Appears more consistent with current business models than regional licensing. Businesses wanting to exploit small areas are not deterred by bidding for large areas than they want to serve.	The administrative costs of coordinating individual assignments would be high.	Use of the spectrum would be patchy, unless this approach resulted in the establishment of a large number of base stations across the country, and this would make it difficult to assign unused spectrum for other purposes.
Licence small areas	Appears more consistent with current business models than regional licensing. Businesses wanting to exploit small areas are not deterred by bidding for large areas than they want to serve.	If regional services are efficient, the transaction costs of amalgamating small area licences may be a disincentive to amalgamation.	Similarly to risk with base station licensing, use of the spectrum might be patchy and make it difficult to assign unused spectrum for other purposes.
Licence existing regions but with a low reserve price	The award process is relatively simple and low cost. Coordination costs are also relatively low. Operators are free to establish services anywhere within a region without reference to Ofcom	If the bulk of demand for the spectrum is to operate small areas, potential users will face transaction costs in getting rights to use the spectrum, though if trading works smoothly, transaction costs may not be high.	Unless reserve prices are set low enough not to be a deterrent to small operators, but high enough so that the award process is efficient, spectrum might not flow to those who value it most.

E.15 The decision for how best to award the spectrum in this band depends on whether viable business models existing for running a service over a small service area or a larger regional area. In view of this uncertainty, the proposal to licence existing regions, but to avoid creating disincentives for smaller potential users through the award process (e.g. setting a low reserve price) appears to be the best option, given the market information available at this time.

Annex F

Glossary

2G

“Two G”: Second generation of mobile telephony systems using digital encoding. 2G networks support voice and limited data communications.

2.5G

“Two and a half G”: term used to describe the enhanced data facilities within 2G digital networks, GPRS and including EDGE

3G

The third generation cellular phone system, currently being deployed, which offers higher data rates than previous systems allowing services such as videophones.

AIP

Administrative incentive pricing. A fee charged to users of the spectrum to encourage them to make economically efficient use of their spectrum.

Airwave Service

Airwave is the commercial name for the company deploying the TETRA service for the UK police and associated emergency services. See TETRA.

Allocation

The process of identifying specific frequency ranges for specific applications; or a frequency band

entered in a table of frequency allocations, for use by a particular category of service.

Analogue

When used in the radio context is the descriptive term for information when relayed directly by radio, with no form of processing.

Assignment

Authorisation given by a licensing authority for a radio station to use a specific radio frequency or channel under specified conditions.

Band

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

Band III

Band “Three” is a range of frequencies generally extending from 170 up to 230 MHz.

Band III Sub Band 1

Ranges from 174 191 MHz

Band III Sub Band 2

Ranges from 193 to 207 MHz

Band III Sub Band 3

Ranges from 209 to 225 MHz

Base Station

A radio transmitter with or without a receiver installed to provide a communications service, typically used in mobile or broadcasting radio systems.

BFWA

Broadband Fixed Wireless Access: similar to Fixed Wireless Access, but generally with data speeds higher than that used by Fixed Wireless Access. See FWA.

CDMA

Code Division Multiple Access: A radio transmission method where individual traffic transmissions use the same frequency, but where users' traffic is separated by means of different codes.

cdma2000

cdma2000 - a 3G mobile phone standard built on the CDMA technology. One of the IMT-2000 family of standards. See CDMA.

Cell Radius

Term used to describe the geographical limit of reliable transmissions from a particular focused transmission beam at a mobile cellular base station or point to multi-point radio system.

CEPT

Conference of European Postal and Telecommunications administrations,

comprising over 40 European administrations.

CAA

Civil Aviation Authority: A public corporation established by Parliament in 1972 as an independent specialist aviation regulator and provider of air traffic services.

Cave Review

Review of Radio Spectrum Management, by Professor Martin Cave, published March 2002, available at:

<http://www.ofcom.org.uk/static/archive/ra/spectrum-review/index.htm>

cdmaOne™

cdmaOne™ is the commercial name a 2G mobile phone systems based on CDMA (Code Division Multiple Access) access technology defined by a number of equipment manufactures as an alternative to GSM technology.

Common Base Station (CBS)

A base station for PBR shared by users (also known as a community repeater); or a PBR installation giving wide area coverage under the control of one or more operators offering mobile communications on a commercial basis to a number of independent (usually business) users.

Communications Act

Communications Act 2003, which came into force in 2003.

Coordination

This term refers to the process under which a new user seeks the agreement of existing users to share access to a particular range of frequencies while avoiding harmful interference.

DAB

Digital Audio Broadcasting. A standard for digital radio.

dBW

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

DCS 1800

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

DEC

In the context of CEPT, an agreed harmonisation measure to which administrations may commit themselves.

DECT

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

GSM/DECT – Guard band

The guard band between the GSM 1800 radio service and the DECT

cordless phone product. See DCS 1800, DECT, and Guard Band.

Digital PAMR

A fully digital implementation of PAMR in both management and traffic relayed. See PAMR.

DSL

Digital Subscriber Line: a method of sending data over existing copper telephone cables that increases the data capacity above that of traditional dial-up data rates.

EC

European Commission: is one of the five institutions that look after the running of the European Union (EU). It is the main body that handles the day-to-day running of the EU in areas such as Transport and Telecommunications.

ECC

Electronic Communications Committee: a committee that reports to CEPT.

EDGE

Enhanced Data Rates for Global Evolution: an access technology that delivers broadband-like data speeds to mobile devices at data speeds faster than is possible with GSM/GPRS.

EIRP

Equivalent Isotropically Radiated Power is a theoretical measure of the power radiated by a transmitter/antenna - defined as the product of the power supplied to the

antenna and the antenna gain in a given direction relative to an isotropic antenna.

EN

European Norm: a prefix attached to ETSI equipment standards that indicates its European position.

ENG

Electronic News Gathering: the production of news programming who use radio in the course of their work, see also PMSE and OB.

ERC

European Radio Communications Committee: a previous committee of CEPT, the functions of which have been taken over by ECC. See ECC..

ERP

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

ETSI

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

EU

European Union: Collective of European Member States.

FDD

Frequency Division Duplex: A transmission method where the downlink/downstream path and the uplink/upstream path are separated by frequency.

Fixed Links

Communications links between fixed points. Such links may be unidirectional or bi-directional.

Fixed Point to Point Links (P-P)

Radio service which links two fixed specific locations.

FS

Fixed Services: radio service where all ground based transmissions are to and from fixed, non mobile, stations.

FSS

Fixed Satellite Services: A satellite system, where the ground or earth station is fixed during transmission and/or reception.

FWA

Fixed Wireless Access: radio link to the home or the office from a base station to give access to telecommunications services.

Guard Band

Frequency range deliberately kept vacant between assignments to give a level of protection to users on either side from interference from each other.

GHz

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

GPRS

General Packet Radio Service: a method to increase the data capacity of 2G or voice based digital networks to enable real time data services such as internet browsing, e-mail, visual communications etc.

GSM

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

GSM 900

GSM 900: term used to describe GSM used in the 900 MHz frequency band. See GSM.

GSM 1800

GSM 1800: term used to describe GSM used in the 1800 MHz frequency band. Sometimes also known as DCS 1800. See GSM and DCS 1800.

GSM – R

This is a variant of the GSM standard developed specifically for use by the railways.

HSDPA

High-Speed Downlink Packet Access: an add-on access component used to enhance the data speed to the end user on 3G/UMTS networks.

IEEE

Institute of Electrical and Electronics Engineers: A US based standardisation organisation that produces equipment standards for, amongst other things, radio access systems.

IMT-2000

International Mobile Telephony 2000: a family of global standards for mobile phone networks proposed by the ITU. Also referred to as 3G.

Interference

The effect of unwanted signals upon the reception of a wanted signal in a radio system, resulting in degradation of performance, misinterpretation or loss of information compared with that which would have been received in the absence of the unwanted signal.

ITU

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

JFMG

JFMG Ltd undertakes licensing of programme-making and special events spectrum (see PMSE, OB and ENG)

on behalf of Ofcom, administering licences and collecting licence fees.

kHz

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

L Band

A range of radio frequencies around 1.5 GHz.

Liberalisation

Allowing licence holders to change the use to which they put their spectrum, within constraints to prevent interference.

Licence Class

Type of licence issued by Ofcom, for example PAMR. Volume classes refer to those licence classes for which there are significant numbers of licensees, for example on site PBR with 26,000 licensees.

Licence Exempt

Allowing anyone to use the spectrum for any application under certain specified restrictions, but typically with maximum power levels. The current regulations are the Wireless Telegraphy (Exemption) Regulations 2003 (SI 2003 No. 74), available at: <http://www.legislation.hmso.gov.uk/si/si2003/2003074.htm>

MHz

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

Mobile Broadband

The use of broadband data access at speed (i.e. faster than walking pace).

Mobile Satellite (MSS)

A service between mobile earth stations and one or more space stations.

MoD

Ministry of Defence:

MWS

Multimedia Wireless Systems: term created within the CEPT Project Teams to describe a converged wireless platform that would supply two data services, video on demand and broadcasting.

National Autonomy Study

A study commissioned by the Radiocommunications Agency towards the end of 2003 and concluded under Ofcom. The objective of the study was to look at the possibilities for the UK to use spectrum in a different way to our continental neighbours and what technical constraints we would need to apply to avoid interference and meet international obligations.

OB

Outside Broadcast: the use of radio in the production of film, television programming, but are not necessarily involved in news programming, see ENG.

Ofcom

Office of Communications. Ofcom took over the RA's responsibility for

spectrum management in the UK in December 2003.

Oftel

Office of Telecommunications, which was the telecommunications regulator, until its functions transferred to Ofcom in December 2003.

Paired spectrum

Used by FDD systems where two frequency bands are used together, one for transmission in the forward or downlink direction (e.g. base station to handset) and another for transmission in the reverse or uplink direction (e.g. handset to base station).

PAMR

Public Access Mobile Radio. A mobile radio service where a number of different organisations have access to a common radio system.

Partial Transfer

In a spectrum trading market, licence holders may transfer only a part of the rights and obligations associated with their spectrum licence - whereby the licence can be divided (e.g. partitioned) by geography, frequency and by time.

PBR

Private Business Radio (previously known as Private Mobile Radio (PMR)). A private radio service installed and operated by businesses and public sector organisations to provide mobile communications for their own workforce.

PBR – On Site

As PBR but with a range limited to within 3 or 6 kms of a nominated location.

PBR – Wide Area

As PBR but range extension is permitted beyond the regulated limit (if technically possible).

PDC

Personal Digital Communication: an alternative 2G mobile phone technology which is used in Japan.

Point-to-Multipoint

Fixed radio system that transmits from a central point to multiple users and/or multiple sites.

PMR

Private Mobile Radio. See PBR.

PMSE

Programme Making & Special Events: A collective term used to describe the provision of News, Film, Television, Stage, Concert and Sports programming through the use of radio.

Primary

This is a term used to indicate that a frequency allocation for a particular service has priority over other services in the same band. It is quite frequent to have several services that are 'co-primary' (e.g. fixed and mobile) where both services have equal priority. See paragraphs 5.23 to 5.33 of the ITU Radio Regulations.

Primary Assignment

The initial allocation of spectrum by the regulator.

Propagation

The transmission of radio waves. Propagation characteristics depend on frequency and are affected by the environmental conditions, such as terrain and atmospheric conditions, encountered on the path.

RA

The Radiocommunications Agency: a former executive agency of the Department of Trade and Industry, which was responsible for the management of most non-military spectrum in the UK and for representing the UK in relevant international bodies. The RA's functions transferred to Ofcom in December 2003.

Radio Spectrum

A section of frequencies of electromagnetic radiation in the range of approximately 10 kHz to 3000 GHz.

RIA

Regulatory Impact Assessment: A process undertaken by policy makers to show why a particular decision was made.

RSA

Recognised Spectrum Access: A method of recognising the use of radio spectrum by an operator which is not covered by a Wireless Telegraphy Act Licence or a Licence Exemption.

RR

Radio Regulations: an international treaty produced by the ITU that sets out at a global level how spectrum should be used by countries. The Radio Regulations are developed and maintained by WRCs. See WRC.

RRC

Regional Radio Conference: an ITU conference established to produce a regional agreement on the use of the spectrum for a specific purpose such as broadcasting.

Safety of Life Services

Services provided by organisations who use radio spectrum to protect the lives of individuals, such as the emergency services.

Scanning Telemetry

Radio Frequencies that are licensed to the water, electricity and gas companies for the purposes of data collection and telecommand.

Secondary

This term is defined in paragraphs 5.28 to 5.31 of the ITU Radio Regulations. Stations of a secondary service shall not cause harmful interference to primary services or claim protection from harmful interference from primary services. See 'Primary'.

Spectrum Framework Review (SFR)

Ofcom consultation on how spectrum will be managed in the future published in November 2004.

Spectrum Mask

A way of specifying the amount of power that a transmitter is allowed to transmit into neighbouring frequency channels.

Spectrum Tariff Unit

An average tariff per MHz of spectrum used.

Spectrum Trading

Process through which spectrum licence holders are able to transfer some or all of their rights to a third party.

TACS

Total Access Communication System: An analogue cellular mobile telephone standard originally used in the UK on the first cellular telephony system. TACS operated in the 900MHz frequency band.

T-DAB

Terrestrial version of DAB, see Terrestrial and DAB.

TDD

Time Division Duplex: A transmission method where the downlink/downstream path and the uplink/upstream path are separated by time.

Terrestrial

Terrestrial radio service: any radio service other than a space service or radio astronomy.

TETRA

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

Trading Regulations

The Statutory Regulations that facilitate Spectrum Trading.

UHF

Ultra High Frequency: Term used to describe frequencies in the range 300 MHz to 3 GHz.

UHF I

UHF frequency band from 410 – 450 MHz.

UHF II

UHF frequency band from 450 – 470 MHz.

UIC

Union Internationale des Chemins de Fer (International Union of Railways) - the role of the UIC is to promote cooperation between railways at the world level and to carry out activities to develop international transport by rail.

UMTS

Universal Mobile Telecommunications System – a 3G mobile phone standard built on W-CDMA technology. See W-CDMA. One of the IMT-2000 family of standards. This is the standard being deployed by the vast majority of European mobile phone operators to offer 3G services.

Undue Interference

Interference with any wireless telegraphy that is harmful, as provided by section 183 Communications Act 2003. This includes interference that creates dangers or risks of dangers to the functioning of any radiocommunications service designed for the purposes of navigation or safety services, or if the interference degrades, obstructs or repeatedly interrupts authorised broadcasting or other wireless telegraphy.

Un-paired spectrum

Used by TDD systems where only one frequency band is used for transmitting in both the forward or downlink direction (e.g. basestation to handset) and the reverse or uplink direction (e.g. handset to basestation).

UTRA

UMTS Terrestrial Radio Access. This term specifically refers to the radio interface standard of UMTS.

UTRA FDD

UTRA FDD: a variant of the UMTS radio interface standard which uses paired spectrum in FDD mode, see FDD.

UTRA TDD

UTRA TDD: a variant of the UMTS radio interface standard which uses unpaired spectrum in TDD mode, see TDD.

UWB

Ultra wide band. A technology that spreads a low-power signal over a wide range of frequencies.

VHF

Very High Frequency: term used to describe frequencies in the range 30 to 300 MHz.

WARC

World Administrative Radio Conference. The name previously given to WRCs. The last WARC was held in 1992, since then they have been referred to as WRCs see WRC.

WRC

World Radiocommunications Conference: an ITU convened conference, held approximately every two or three years, which updates the International Radio Regulations.

W-CDMA

Wideband – CDMA, a version of CDMA that has a bandwidth wider than that defined in the original CDMA consideration. See CDMA. The term W-CDMA is often used as an alternative to UMTS

Wi-Fi™

WiFi™ is a short-range wireless broadband technology that allows Internet users to access at so-called hot spots in coffee shops, railway stations and airports and which is used as the basis for most home wireless networking. WiFi™ is built on the IEEE802.11 (Wireless Local Area Network) Standard.

Wi-Fi™ Alliance

The Wi-Fi™ Alliance is a not for profit industry organisation that certifies interoperability of WiFi™ radio

equipment that meets parts of the IEEE802. standard.

WiMAX™

WiMAX™ is a new technology that is similar to WiFi™. However, unlike WiFi's 150-foot range, WiMAX™ has a reach of several miles, offering a way to bring broadband data and the Internet to both domestic and business customers. WiMAX™ is built on the IEEE802.16 and ETSI HiperMAN (Metropolitan Area Network) standards.

WiMAX™ Forum

The WiMAX™ Forum is a not for profit industry organisation that certifies interoperability of WiMAX™ radio equipment meeting parts of the

IEEE802.16 and ETSI HiperMAN standards.

Wireless Telegraphy

The means of sending information without the use of a wired system.

WT Acts

Wireless Telegraphy Act 1949 (as amended by the Wireless Telegraphy Act 1967) and Wireless Telegraphy Act 1998. These Acts are further amended by the Communications Act 2003. WT Acts regulate the use of civil radio spectrum in the UK.

WT Act licences

Licences issued under the Wireless Telegraphy Act 1949 (as amended).