



Digital Dividend Review:
band manager award
Consultation on detailed award design

Consultation

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Section 1

Executive summary

Introduction

- 1.1 This consultation document sets out proposals for the award of part of the spectrum freed up for new uses by digital switchover (DSO). We call the spectrum made available by DSO the “digital dividend.” The UK’s digital dividend has been the focus of our Digital Dividend Review (DDR) since we launched it in 2005.¹
- 1.2 There are two distinct categories of spectrum in the digital dividend: the spectrum that will be cleared of terrestrial television by the end of 2012 (cleared spectrum) and capacity available within the spectrum that will be used to carry the six digital terrestrial television (DTT) multiplexes after DSO (interleaved spectrum). This document is concerned with the interleaved spectrum, so called because not all of the spectrum in any particular location will be used for DTT and so is available for other services on a shared (or interleaved) basis.
- 1.3 This document is one of three separate consultations on implementing the digital dividend awards. Two other consultation documents set out our proposals for the detailed design of the award of the cleared spectrum² and of the award of geographic packages of interleaved spectrum suitable for local television.³
- 1.4 Our objective for the DDR is to maximise the total value to society that using the digital dividend is likely to generate over time. It is not our objective to raise revenue for the Exchequer, nor is this a consideration that we can take into account given our statutory duties.

Programme-making and special events

- 1.5 Users of spectrum for programme-making and special events (PMSE) comprise a wide variety of organisations and individuals, including many thousands of business and professional users in broadcasting and entertainment. We recognise the contribution that PMSE users make to the interests of both citizens and consumers.
- 1.6 The way in which PMSE users access spectrum is therefore a very important issue. This document makes proposals for how PMSE users can continue to access spectrum while allowing other important uses to emerge and flourish.
- 1.7 Our general approach to spectrum management is to rely more on the market and less on regulation as the way to promote the best use of spectrum. This is because we want to give users the flexibility to decide how spectrum should be used and to change that use as technologies and consumers’ interests change. But we also recognise that PMSE is in a different position to other potential uses of spectrum. PMSE users are disparate and fragmented and currently face difficulties coming together to aggregate their demand for spectrum. This problem of coordination means that any attempt to

¹ More information about the DDR, including previous publications, is available from our website at www.ofcom.org.uk/radiocomms/ddr/.

² www.ofcom.org.uk/consult/condocs/clearedaward/condoc.pdf. Published 6 June 2008. Consultation closes 15 August 2008.

³ www.ofcom.org.uk/consult/condocs/ddrinterleaved/interleaved.pdf. Published 12 June 2008. Consultation closes 21 August 2008.

move to a market-based approach to spectrum access in the short term could lead to significant disruption for PMSE users and possibly market failure.

- 1.8 Our view remains that it is right to move to a market-based approach and that this is very much in the interest of citizens and consumers. But we must achieve this in a way that both avoids significant disruption and helps to increase PMSE users' own ability to participate in a more market-based world.
- 1.9 We must also be mindful of the risk that regulation leads to unintended consequences and does not achieve the desired outcome. This means that we need to be careful to intervene only where necessary and to be mindful of the potential for our decisions to have negative as well as positive consequences.
- 1.10 We set out how we would approach this in the DDR statement published on 13 December 2007.⁴ We decided that we would award a single package of interleaved spectrum via a comparative selection process (also known as a beauty contest) to a licensee that would act as a band manager. To help PMSE users with the transition to market mechanisms, we would use criteria designed to ensure that the band manager's interests were aligned with those of PMSE users. The band manager would pay a charge for the spectrum based on Administered Incentive Pricing (AIP) and would be able to earn revenue by charging its customers for access. But regulation would ensure that it had to meet reasonable demand from PMSE users on fair, reasonable and non-discriminatory (FRND) terms. So long as these obligations were met, the band manager would be able to allow others to make use of its spectrum. We also decided that channel 69 should continue to be available for PMSE use throughout the UK on a licensed basis and that we would promote greater licence-exempt use of channel 70 for PMSE, in the interests of community users.
- 1.11 The proposals set out in this document provide for the detailed implementation of our approach. We have no doubt that they will stimulate further debate. We look forward to continued dialogue with PMSE users and other stakeholders in order to refine our plans as we move toward implementation.
- 1.12 In formulating our proposals, we have been mindful of the impact they could have on PMSE users. This recognises our desire to avoid significant disruption. Nonetheless, our proposals will lead to change, and PMSE users will need to adapt to these changes. In part, this will involve migrating from higher to lower-cost spectrum. Where this is the case, we will work with PMSE users to help them identify suitable alternatives and ways to minimise disruption to their ongoing activities. We welcome views on how best we can do this.

Availability of interleaved spectrum for PMSE after DSO

- 1.13 We are aware that professional users of wireless microphones are concerned about the amount of interleaved spectrum they will be able to access in certain locations after DSO. These users also argue that the post-DSO configuration of interleaved spectrum may require investment in new equipment, particularly for touring productions.
- 1.14 We do not address this specific issue in this document, which is concerned with the future institutional arrangements for all PMSE access to all spectrum. But we continue to work on the basis that there should be broadly sufficient capacity in the interleaved spectrum to be awarded to the band manager to allow existing PMSE use to be

⁴ www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf.

accommodated. We will continue to work with affected stakeholders to address their concerns and help them to identify ways to manage the transition through DSO.

- 1.15 Moreover, we wish to reassure PMSE users that we will work with them to ensure a smooth transition toward a market-based approach to spectrum access. In line with our key objective of avoiding significant disruption, we will ensure that there is continuity of service to enable PMSE users to access spectrum suitable for their needs.

Detailed proposals

- 1.16 Table 1 sets out a summary of our detailed proposals for this award.

Table 1. Summary of proposals for the band manager award

Available spectrum	Our proposals for consultation
Spectrum included in the band manager award	We propose to include most of the spectrum currently allocated to PMSE in 75 distinct bands between 47.55 MHz and 48.4 GHz
Licence conditions	Our proposals
Type of technical licence conditions	We propose to define the available spectrum in the form of block-edge masks (BEM)
Multiplex ownership and interoperability	<p>We propose to include certain restrictions on ownership in relation to use of interleaved spectrum to operate new DTT multiplexes. These would reflect the similar regime under the Broadcasting Act 1990⁵ as amended (e.g. preventing religious or political bodies from holding licences for this purpose)</p> <p>We also propose to facilitate technical interoperability between any new DTT services using interleaved spectrum and existing DTT services</p> <p>These proposals are mirrored in our consultation documents on the detailed design of the cleared and geographic interleaved awards</p>
Licence term	We propose that the licence should have an indefinite duration
Period of notice	<p>For bands that are currently used for PMSE, we propose that we would have the right to vary or revoke the licence on spectrum-management grounds subject to giving the band manager one year's notice</p> <p>For other bands, where there is no current PMSE use, we propose that we would have the power to vary or revoke the licence on spectrum-management grounds subject to giving the band manager five years' notice</p>
Licence fees	We propose that the band manager should be subject to AIP and pay an annual licence fee based on the economic value of its spectrum. The fee will be calculated on a band-by-band basis

⁵ www.opsi.gov.uk/acts/acts1990/Ukpga_19900042_en_1.

Award process	Our proposals
Award process	We propose to award a single package of spectrum by means of a beauty contest
Selection criteria	<p>We propose to base the selection on:</p> <ul style="list-style-type: none"> • the extent to which each applicant will secure efficient use of the spectrum to be awarded for both PMSE and other uses; • the extent to which each applicant demonstrates an understanding of, and a commitment to, the needs of PMSE users; and • the financial, managerial and technical ability of each applicant to establish and maintain efficient systems and procedures to secure efficient use of the spectrum to be awarded for both PMSE and other uses
PMSE protection measures	Our proposals
The band manager's commitment to PMSE users	<p>We propose that each applicant should make specific commitments to PMSE users to be incorporated in the licence awarded:</p> <ul style="list-style-type: none"> • on pricing policy in light of our stated policy that prices to PMSE users should be FRND; • on allowing PMSE users to access spectrum for which they are prepared to pay; • on the service levels that PMSE users will receive; and • on dispute resolution, covering both internal processes and the use of alternative dispute resolution (ADR) where internal processes do not satisfy PMSE users
Annual audit of the band manager's performance	We propose to put in place an independent annual audit of the band manager's performance, comparing this with the commitments given by the band manager to PMSE users. We will publish the results of each audit on our website
Review of the band manager's performance	We propose to conduct formal reviews of the band manager's performance, with specific reference to the progress that the PMSE sector has made to a market-based approach for spectrum access. These reviews would probably be held every three years and include a review of the band manager's AIP-based licence fee
Our powers to revoke or vary the band manager's licence	We consider that it may be appropriate for us to vary or revoke the licence in circumstances where there is clear evidence that the band manager is failing to meet its obligations to PMSE users effectively

Question 1. The executive summary sets out our proposals for the DDR band manager award. Do you agree with these proposals?

Next steps

- 1.17 This consultation closes on 16 October 2008. We will hold a seminar on our proposals during the consultation period.
- 1.18 We expect to publish a second consultation document before the end of the year on issues not addressed in detail in this document, namely:
- the means by which the band manager will authorise PMSE and other users to access its spectrum;
 - detailed technical licence conditions; and
 - the levels of AIP that the band manager will pay.
- 1.19 More information about next steps is set out in section 10.

Section 2

Introduction

- 2.1 The first phase of the DDR concluded with the publication of the DDR statement. In it, we set out our decisions on the strategic approach we would take to the release of the UK's digital dividend – the spectrum freed up by DSO. Some of those key decisions were as follows:
- we confirmed our proposal to take a market-based approach to awarding the digital dividend, and in doing so we decided to give users flexibility to decide its optimum use and to auction the spectrum. We decided not to intervene to reserve spectrum for any particular use except for a single package of interleaved spectrum and channel 69 that would be awarded via a beauty contest to a band manager with obligations toward PMSE users;
 - we decided to auction geographic packages of interleaved spectrum suitable but not reserved for local television;
 - we proposed to allow licence-exempt cognitive access to the interleaved spectrum (provided this would not result in harmful interference to other licensed users) but decided not to set aside any of the digital dividend exclusively for licence-exempt use or as an innovation reserve;
 - we decided to include channel 36 in the award of the cleared spectrum and proposed to award the interleaved spectrum in channels 61 and 62 alongside this spectrum; and
 - we decided to continue with our timetable of awarding the digital dividend as soon as possible, which meant that we envisaged holding the band manager award in 2009.
- 2.2 This consultation document is one of three documents. The other two documents set out our proposals for the detailed design of the award of cleared spectrum and of the award of geographic packages of interleaved spectrum. Later this year, we will publish a further consultation document setting out our proposals on licence-exempt cognitive access to the interleaved spectrum.
- 2.3 This document focuses on our proposals for the detailed design of the award of spectrum to a band manager with obligations toward PMSE users. Specifically, we consider:
- the inclusion of bands from outside the digital dividend in the award;
 - the duration of the licence that will be awarded to the band manager;
 - the selection criteria that we will apply in the beauty contest and our approach to determining the successful applicant;
 - the choice of technical and non-technical conditions to be included in the band manager's licence; and
 - how to ensure that reasonable PMSE demand for the spectrum to be awarded is met on FRND terms.

- 2.4 This document does not cover the means by which the band manager will authorise PMSE and other users to access its spectrum. We will address this issue in a second consultation document that we expect to publish before the end of the year following further detailed consideration of the existing legal framework for spectrum trading.
- 2.5 Our objective in awarding the digital dividend is to maximise the total value to society that using this spectrum is likely to generate over time. It is not our objective to raise revenue for the Exchequer, nor is this a consideration that we can take into account given our statutory duties.

Structure of this document

- 2.6 This document is structured as follows:
- section 3 sets out the legal framework within which we operate.
 - section 4 sets out our objectives for future PMSE access to the digital dividend, including a summary of the work already done and the approach detailed in the DDR statement;
 - section 5 addresses the spectrum to be awarded to the band manager. In particular, it considers spectrum outside the digital dividend currently allocated for PMSE use;
 - section 6 sets out our proposals for the licence duration for those bands that we propose to award to the band manager, with particular focus on the notice period for varying or revoking the band manager's licence;
 - section 7 sets out how we propose to design the beauty contest that will select the band manager, in particular the selection criteria that we propose to adopt for making our selection and the process we will follow in doing so;
 - section 8 makes proposals for technical and non-technical licence conditions. It explains our proposed approach to spectrum usage rights (SURs), managing interference, introducing AIP and DTT multiplex issues;
 - section 9 sets out our proposals for protecting PMSE use of the spectrum to be awarded during the transition to a market-based approach, taking into account the competition implications of our decision to award a single package of spectrum to one band manager. It addresses the spectrum requirements of the London 2012 Olympic Games and Paralympic Games and the Glasgow 2014 Commonwealth Games; and
 - section 10 describes the next steps for this award.

Section 3

Legal framework

Introduction

3.1 In this section, we describe our functions, duties and objectives as they relate to the DDR awards. We also provide a brief overview of the international provisions that impact on the potential future uses of the digital dividend.

Our functions, duties and objectives

3.2 We make decisions within a framework defined in European Union (EU) and UK law. This sets out overarching general duties that apply across all our functions, below which sit a number of specific duties.⁶

The duties imposed by the Communications Act 2003

3.3 Section 3 of the Communications Act 2003⁷ sets out our general duties and provides that our principal duties are:

- to further the interests of citizens in relation to communications matters; and
- to further the interests of consumers in relevant markets, where appropriate by promoting competition.

3.4 In securing the above duties, we are required to secure among other things the optimal use for wireless telegraphy of the electromagnetic spectrum and the availability throughout the UK of a wide range of electronic communication services and to have regard to the different needs and interests of everyone who may wish to use the spectrum for wireless telegraphy.

3.5 Section 3(3) of the Communications Act provides that in performing our principal duties, we must in all cases have regard to the principles of transparency, accountability, proportionality and consistency as well as ensure that our actions are targeted only at cases in which action is needed.

3.6 Section 3(4) of the Communications Act requires us in performing our principal duties to have regard to a number of factors as appropriate, including the desirability of promoting competition, encouraging investment and innovation in relevant markets and encouraging the availability and use of high-speed data-transfer services throughout the UK.

3.7 Where there is a conflict between our duties, priority must be given to the European Community requirements set out in section 4.

European Community requirements

3.8 Section 4 of the Communications Act implements article 8 (policy objectives and regulatory principles) of Directive 2002/21/EC on a common regulatory framework for

⁶ See annex 6 of the DDR statement for a more detailed overview of the statutory duties relevant to the DDR.

⁷ www.opsi.gov.uk/acts/acts2003/pdf/ukpga_20030021_en.pdf.

electronic communications networks and services (the Framework Directive).⁸ This sets out the objectives that national regulatory authorities must take all reasonable steps to achieve. These include the promotion of competition in the provision of electronic communications networks and services by, among other things, encouraging efficient investment in infrastructure and promoting innovation, and encouraging efficient use of radio frequencies; and contributing to the development of the internal market by, among other things, removing obstacles to the provision of electronic communications networks and services at a European level, encouraging the interoperability of pan-European services and ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services.

3.9 Article 8 also requires EU Member States to ensure that, in carrying out their regulatory tasks, national regulatory authorities take the utmost account of the desirability of making regulations technologically neutral.

Our duties when carrying out our spectrum functions

3.10 In carrying out our spectrum functions, we have a duty under section 3 of the Wireless Telegraphy Act 2006⁹ to have regard in particular to:

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

3.11 We also have a duty to have regard, in particular, to the desirability of promoting:

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

3.12 Where it appears to us that any of our duties under section 3 of the Wireless Telegraphy Act conflicts with one or more of our general duties under sections 3 to 6 of the Communications Act, priority must be given to our duties under the latter. Section 5 of the Communications Act concerns our obligation to carry out our functions in accordance with any directions made by the Secretary of State. Section 6 concerns duties to review regulatory burdens.

Granting wireless telegraphy licences

3.13 The Wireless Telegraphy Act sets out our legal power to grant wireless telegraphy licences. Section 8(1) makes it an offence for any person to establish or use any station for wireless telegraphy or to install or use any apparatus for wireless telegraphy

⁸ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0033:0050:EN:PDF>.

⁹ www.opsi.gov.uk/acts/acts2006/pdf/ukpga_20060036_en.pdf.

except under and in accordance with a licence granted by us under that section (a wireless telegraphy licence).

- 3.14 Section 9(1) of the Wireless Telegraphy Act gives us the power to grant wireless telegraphy licences subject to such terms as we think fit.
- 3.15 However, our broad discretion in relation to the terms that can be imposed in a wireless telegraphy licence is subject to the rule that we must impose only those terms that we are satisfied are objectively justifiable in relation to the networks and services to which they relate, not unduly discriminatory and proportionate and transparent as to what they are intended to achieve (see section 9(7)).
- 3.16 Under section 8(4) of the Wireless Telegraphy Act, we have the duty to exempt from licensing any use of wireless telegraphy apparatus that we consider is not likely to cause harmful interference. Licence exemptions are granted by way of regulations made under section 8(3).

Providing for the award of wireless telegraphy licences

- 3.17 Under Article 5(2) of Directive 2002/20/EC on the authorisation of electronic communications networks and services (the Authorisation Directive),¹⁰ when granting rights of use of radio frequencies (wireless telegraphy licences in the UK context), Member States must do so through open, transparent and non-discriminatory procedures.
- 3.18 Under Article 7(2) of the Authorisation Directive, where the number of rights of use of radio frequencies needs to be limited, Member States' selection criteria must be objective, transparent, non-discriminatory and proportionate. Section 29 of the Wireless Telegraphy Act requires us to make an order setting out the criteria.

Charging fees for wireless telegraphy licences

- 3.19 Under Article 13 of the Authorisation Directive, any fees imposed for rights of use of radio frequencies must reflect the need to ensure the optimal use of the resources. Such fees must be objectively justifiable, transparent, non-discriminatory and proportionate in relation to their intended purpose and take into account the objectives set out in article 8 of the Framework Directive.
- 3.20 Section 12 of the Wireless Telegraphy Act permits charging for wireless telegraphy licences by enabling us to prescribe in regulations sums payable for these licences. This power enables us to recover the cost of administering and managing wireless telegraphy licences. Section 13 of the Wireless Telegraphy Act permits us to recover sums greater than these if we think fit in the light (in particular) of the matters to which we must have regard under section 3, including promoting the efficient management and use of the part of the electromagnetic spectrum available for wireless telegraphy.
- 3.21 The fees for most wireless telegraphy licences (including those fees that we set in order to incentivise the efficient use of the spectrum) are set out in specific regulations. The current regulations are the Wireless Telegraphy (Licence Charges) Regulations 2005 (SI 2005/1378) (as amended).¹¹

¹⁰ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0021:0032:EN:PDF>.

¹¹ www.opsi.gov.uk/si/si2005/uksi_20051378_en.pdf.

Objective for the DDR

- 3.22 Taking account of our duties and our spectrum-management strategy, and as set out in the DDR consultation document published on 19 December 2006¹² and in the DDR statement, our objective for the DDR is to maximise the total value to society that using the digital dividend is likely to generate over time. It is emphatically not our objective to award the digital dividend to raise revenue for the Exchequer. Given our duties, this is not a consideration we can take into account.

International regulatory framework for electronic communications

- 3.23 Spectrum management in the UK takes place within international frameworks set both globally and in the EU. Under the Radio Spectrum Decision,¹³ the European Commission can adopt Decisions governing spectrum use. This can be done in the interests of ensuring effective policy coordination and, where appropriate, harmonised conditions for spectrum use in the internal market. These Decisions are binding on Member States and can only be adopted by the Commission with the support of a qualified majority of them, convened as the Radio Spectrum Committee (RSC). We represent the UK at RSC under direction by the Government.
- 3.24 The Radio Spectrum Policy Group (RSPG) works in parallel with RSC and also draws its membership from Member States. Again, we represent the UK under direction by the Government. RSPG's role is to give strategic advice to the Commission on major questions of spectrum policy. It does this by adopting Opinions, which are not binding but can have significant influence as they represent the prevailing view of Member States.
- 3.25 Three recent developments are particularly relevant to the DDR awards because of their potential implications for the spectrum that we can award and how we can award it.
- 3.26 First, the World Radiocommunication Conference 2007 (WRC-07) agreed in November 2007 to change the international Radiocommunication Regulations to make spectrum currently used for analogue terrestrial television more flexible, in particular enabling mobile use.
- 3.27 This has limited direct effect on the UK because agreements with other European countries already give us substantial flexibility. But the indirect benefits of the agreement could be large, opening up the prospect that many more countries will make a digital dividend available for new wireless services. This will help to create global economies of scale for equipment, so increasing choice and reducing prices for UK consumers.
- 3.28 Second, and in the same month, the European Commission published a Communication on a common approach to the digital dividend in Europe.¹⁴ This recommended identifying common bands that could be optimised by enabling "clusters" of services using a similar type of communications network: broadcasting, mobile multimedia and mobile broadband. These bands would be planned and harmonised in some form at EU level. The Communication was published at the same time as a package of proposals for amending the legislation defining the EU regulatory framework for electronic communications networks and services.

¹² www.ofcom.org.uk/consult/condocs/ddr/ddrmain.pdf.

¹³ http://eur-lex.europa.eu/LexUriServ/site/en/oj/2002/l_108/l_10820020424en00010006.pdf.

¹⁴ http://ec.europa.eu/information_society/policy/ecomms/doc/library/proposals/com_dd_en.pdf.

3.29 The Communication concluded by indicating that the Commission would prepare the required measures to reserve and coordinate the common bands at EU level if necessary. Clearly, our award of the digital dividend will need to comply with any mandatory EU measures.

3.30 Member States responded to the Communication in the form of conclusions of the Council of the EU, adopted on 12 June 2008.¹⁵ These invited the Commission:

To initiate the studies and consultations necessary to define a coherent basis for the coordinated usage of spectrum on a non-exclusive, non-mandatory basis, notably including the technical aspects, the cost analysis and the socioeconomic impact of different options and the regulatory conditions for accessing spectrum;

and:

To report to Council by December 2008 on the results of this process and on any further steps required.

3.31 The European Parliament is expected to respond to the Communication in September 2008.

3.32 Third, the European Conference of Postal and Telecommunications Administrations (CEPT), in its response of 8 July 2007 to a Commission mandate on technical considerations regarding harmonisation options for the digital dividend dated 30 January 2007,¹⁶ concluded that the preferred sub-band for the harmonised mobile broadband cluster proposed by the Commission is the upper part of UHF band V and should include, as a minimum, channels 62-69 (798-862 MHz) as offering the best possibility for Europe-wide non-mandatory, non-exclusive harmonisation.¹⁷ This same spectrum including channel 61 (thus expanding the range to 790-862 MHz) was then subsequently the subject of decisions at WRC-07 to enhance flexibility for mobile usage.

3.33 Following a second Commission mandate dated 3 April 2008,¹⁸ work continues within CEPT to identify common technical conditions and international coordination and channelling arrangements. These reports are expected to be available in draft form from the end of 2008, for final delivery by June 2009.

3.34 We will continue to contribute fully to EU discussions in the months to come. At present, we believe that our proposals for the UK digital dividend are not in conflict with discussions currently underway in the above fora. In the meantime, in line with the decision set out in the DDR statement, we believe it right to press ahead with the DDR awards in the interests of bringing benefits to UK citizens and consumers at the earliest possible date.

¹⁵ <http://register.consilium.europa.eu/pdf/en/08/st10/st10820.en08.pdf>.

¹⁶ http://ec.europa.eu/information_society/policy/radio_spectrum/docs/ref_docs/mandate_dig_div.pdf.

¹⁷ http://ec.europa.eu/information_society/policy/radio_spectrum/docs/ref_docs/rsc21_public_docs/rscom07_69_cept_fin_digdiv_b.pdf.

¹⁸ http://ec.europa.eu/information_society/policy/radio_spectrum/docs/ref_docs/rsc23_public_docs/rscom08-06.pdf.

Section 4

Future PMSE access to the digital dividend

Introduction

4.1 This section explains our work so far on PMSE in the context of the DDR and outlines the decisions that we have already made in respect of PMSE access to the digital dividend.

Work so far on PMSE in the context of the DDR

4.2 The DDR consultation document in December 2006 proposed auctioning the interleaved spectrum to promote a flexible market-based approach that would not restrict or limit the use of the spectrum. Because we recognised that the transition to accessing spectrum via market mechanisms could pose a significant risk of disruption to PMSE use of this spectrum, we proposed ensuring continued access until at least the end of 2012, when DSO ends. We also proposed making some or all of channel 69 available for use on a licence-exempt basis given that community users typically do not require their use to be coordinated with others.

4.3 Many respondents argued that a fragmented PMSE sector could not compete successfully at auction and/or that a longer period of transitional access to interleaved spectrum after DSO was needed. They also argued that channel 69 was important for professional users, who require coordinated, interference-free access across the UK, and so should remain available on a licensed basis.

4.4 We reflected on these responses and on 20 June 2007 published a further consultation document on future spectrum access for PMSE.¹⁹ This recognised that a number of factors could make it difficult for the sector to engage in a market for spectrum access quickly and effectively. We identified six options for PMSE access, ranging from maintaining the status quo to an auction without any safeguards to protect access by PMSE users. We assessed these against four key objectives to be pursued in designing future arrangements for access by PMSE users to interleaved spectrum:

- *avoiding disruption to PMSE users that adversely affects their ability to provide a wide range of services to citizens, consumers and business customers.*

This objective is clearly related to our duty to secure the interests of citizens and consumers by ensuring that they can continue to benefit from the many important products and services to which PMSE use of this spectrum is presently integral. However, the objective is more relevant in the short term than the long term as the ability of PMSE users to adapt to change should increase over time;

- *facilitating participation of the PMSE sector in a market-based approach to spectrum.*

This objective is related in particular to our duties to secure the optimal use of spectrum and to promote the efficient management and use of spectrum in the interests of citizens and consumers. Most of our work in relation to spectrum management is focused on the supply of spectrum. However, if we can facilitate PMSE users' ability to participate in a market-based approach to spectrum by

¹⁹ www.ofcom.org.uk/consult/condocs/pmse/pmse.pdf.

helping them to reflect their demand for spectrum more appropriately, we will further improve the means through which citizens' and consumers' needs, tastes and interests can be met efficiently;

- *promoting the optimal use of spectrum in relation to all potential users over time.*

This objective relates to the fact that there are other potential users of interleaved spectrum in addition to PMSE users and that the set of potential uses and users is likely to increase over time given trends in technology and consumer behaviour and the attractiveness of low-frequency spectrum; and

- *avoiding the risks of regulatory and market failure.*

This objective relates to the need to consider carefully the need for, but also the consequences of, regulatory intervention and the fact that this can have adverse, unintended consequences. The risks of regulatory failure can be particularly pertinent in areas with rapid change in technology and consumer behaviour.

Decisions set out in the DDR statement

- 4.5 We explained in the DDR statement in December 2007 that we continued to believe we should address the risk of coordination failure currently faced by PMSE users. This is the risk that users could not at present aggregate their demand to take part in a market-based approach to spectrum access. We explained that we should pay particular attention to how this issue could be overcome, allowing PMSE users to access spectrum via market mechanisms in the longer term.
- 4.6 Our assessment of whether to intervene to resolve this market failure was informed by our assessment of its opportunity cost. Assuming we were able to award some interleaved spectrum in a form suitable for other uses (e.g. local television), our work, set out in annex 2 to the DDR statement,²⁰ suggested that the opportunity cost of resolving this market failure was plausibly at most £250m (net present value over 20 years). This level of opportunity cost was plausibly of a similar order of magnitude to the value that might be generated by using this spectrum for PMSE. Hence, we felt that we should only intervene if we had strong evidence of the risks of market failure and should be mindful of how our method of intervening could reduce the risks of regulatory failure.
- 4.7 We believed that, in this case, the evidence for market failure was compelling. As explained in our PMSE consultation document, there are barriers to PMSE users engaging in a market at this time, and these barriers are sufficiently severe to suggest that a reasonable period of transition is required to overcome them.
- 4.8 To identify which of the potential options for resolving the transitional coordination failure faced by PMSE users was most appropriate, we gave additional thought to the nature of the solution we needed to meet our objectives and how we could mitigate the risk of regulatory failure.
- 4.9 We believed that this solution involved two key elements:
- ensuring that prices for spectrum access increased toward market rates gradually and that users' ability to access spectrum was not suddenly reduced. This would

²⁰ www.ofcom.org.uk/consult/condocs/ddr/statement/ddrannex.pdf.

prevent significant disruption to PMSE users and provide an appropriate transition to a market-based approach, hence avoiding a cliff edge; and

- ensuring that the band manager had flexibility to respond to signals from PMSE users when setting prices and, where appropriate, to promote efficient spectrum use. This would help PMSE users to move to a market-based approach and could also reduce the risk of regulatory failure in relation to this intervention.

4.10 To ensure that these elements were present in our solution, we identified that the following would be required:

- the ability to exert some regulatory control over the prices PMSE users were charged during the transition period;
- the ability to provide PMSE users with some protection in relation to the amount of spectrum they were able to access during the transition period; and
- the ability to ensure that the band manager had incentives to promote efficiency and to assist PMSE users in responding appropriately to market signals.

4.11 Given these requirements, we decided that:

- we would award interleaved spectrum and channel 69 by beauty contest to a band manager. We would seek to ensure through the beauty contest that the band manager's interests were aligned with those of PMSE users;
- the band manager would face AIP as one essential part of developing a market-based approach to spectrum access for PMSE users. The band manager would be able to make spectrum available for other uses but only where this was not needed to satisfy the reasonable needs of PMSE users;
- the band manager would need to make spectrum available to PMSE users on FRND terms;
- the requirements to meet reasonable demand on FRND terms would last until 2018; and
- the band manager's licence would have indefinite duration. We proposed at that time that we would be able to vary or revoke it after a minimum term for spectrum-management reasons. This would enable us to take further steps to protect PMSE users if justified.

4.12 We made no decisions about including spectrum outside the digital dividend and currently used for PMSE in the package to be awarded. This was because there were complex issues relating to ownership of spectrum and technical licence conditions that required further careful consideration and discussion. We said that we would consider this in detail when consulting on detailed award design. We go on to address this and other issues raised by our decisions in the remainder of this document.

Section 5

Spectrum to be awarded

Introduction

- 5.1 The previous section outlined our key objectives for future PMSE access to the digital dividend and the decisions set out in the DDR statement. This section looks at what spectrum, if any, from outside the digital dividend should be included in the package to be awarded to the band manager. Specifically, it considers:
- spectrum currently used for PMSE;
 - Ofcom-managed spectrum, specifically –
 - spectrum that we do not propose to award;
 - options for spectrum that we do propose to award;
 - MOD-managed spectrum; and
 - licence-exempt cognitive access to interleaved spectrum.
- 5.2 In our assessment of Ofcom-managed spectrum, we first identify those bands currently allocated to PMSE (i.e. available for licensed PMSE use) but subject to separate awards or other developments that make continuing access for PMSE unlikely in the long term. We also identify those bands where it is unclear whether they will be available for future PMSE access. These bands are not included in any further assessment of the spectrum to be awarded.
- 5.3 We then identify four options for continued PMSE access to the remaining bands. We assess these options against our four key objectives for future PMSE spectrum access. After concluding on the most appropriate way of providing access, we then look at specific bands to see if they exhibit any features that would warrant a different approach. We do this by profiling bands by their importance to PMSE users, defined in this case by current volumes of use. We then analyse the potential advantages and disadvantages of including these bands in the award in light of our key objectives.
- 5.4 We go on to look at MOD-managed spectrum, which will require a different approach to Ofcom-managed spectrum because of the different arrangements that are likely to bear on future PMSE access.
- 5.5 Finally, we consider which licensed uses of the interleaved spectrum we should specifically protect from harmful interference that would be caused as a result of our allowing licence-exempt cognitive access.

Spectrum currently used for PMSE

- 5.6 Some 2.5 GHz of spectrum in 75 distinct bands (as defined in the UK Frequency Allocation Table) between 47.55 MHz and 48.4 GHz is currently allocated to PMSE.
- 5.7 With the exception of channel 69 and some frequencies used for talkback in UHF bands I and II, this access is on a basis secondary to other uses. In other words, PMSE users are able to access this spectrum on the understanding that they will not interfere

with the service and technology that is the designated primary use. In the interleaved spectrum, this primary use is terrestrial television. Figure 1 shows the spectrum currently allocated to PMSE.

Figure 1. Spectrum currently allocated to PMSE



5.8 Access to spectrum for PMSE users is currently provided by JFMG (Joint Frequency Management Group) on our behalf in accordance with the Contracting Out (Functions Relating to Wireless Telegraphy) Order 1996 (SI 1996/2290).²¹ Users purchase licences directly from JFMG, which charges an administrative fee determined by us.

²¹ www.opsi.gov.uk/si/si1996/Uksi_19962290_en_1.htm.

- 5.9 Only three of the 75 bands – two constituting the interleaved spectrum and the third being channel 69 – lie within the digital dividend. The PMSE consultation and the DDR statement focused on these three bands. This document considers not only these bands but also the other 72 bands currently allocated to PMSE. 54 of these are managed by us and 18 by the MOD. We look shortly at Ofcom-managed spectrum before turning to spectrum managed by the MOD.

Spectrum not allocated to PMSE but frequently used for it

- 5.10 At present, there is also a significant volume of PMSE use of spectrum that is not generally allocated to this use. Access to this additional spectrum is often required to support large events such as the 2007 Tour de France. In that year, use of spectrum not allocated to PMSE accounted for over 2,700 assignments.
- 5.11 The process by which such access is typically gained is that a PMSE user requests use of one of these non-PMSE frequencies from JFMG, which in turn requests permission from us to license it.
- 5.12 We make proposals for defining the reasonable PMSE demand that the band manager will need to meet and for its role in relation to major events in section 9.

Ofcom-managed spectrum

- 5.13 Not all of the spectrum in the 54 Ofcom-managed bands that is currently allocated to PMSE will remain available for this use for the foreseeable future.

Spectrum that we do not propose to award

Channel 38

- 5.14 UK radioastronomy, centred on the Universities of Manchester and Cambridge, is a world leader in research and facility development. This work dates back to the construction of the University of Manchester's Lovell Telescope Jodrell Bank and the subsequent development of the MERLIN (Multi-Element, Radio Linked Interferometry Network) array, now the only world-class telescope facility on UK soil. Cambridge hosts the second-largest telescope of the MERLIN array, others being at sites across the northwest of England.²² The Science and Technology Facilities Council (STFC) and its predecessors have, since the 1980s, contributed to the operating and development cost of this array, today totalling around £2.3m per year.
- 5.15 The array is currently undergoing a major upgrade (e-MERLIN), adding new frequency instruments and fibre-optic links between the telescopes, due for completion in late 2008. STFC also provides funds for the exploitation of the science arising from MERLIN and for UK astronomers to use its telescopes as part of a wider European array (Very Long Baseline Interferometer, based in the Netherlands) and as part of a global telescope array. UK astronomers study phenomena at a wide range of frequencies, from 37 MHz to 98 GHz, though in practice focus on a few key frequencies dictated by science priority. STFC holds Recognised Spectrum Access (RSA) from us, which helps to ensure UK astronomers have access to these key frequencies, including channel 38 (606-614 MHz). Several frequencies are shared with other civil users, and some enjoy further protection via International Telecommunications Union regulations.

²² www.merlin.ac.uk.

- 5.16 We have had no plans to require radioastronomy use of channel 38 to cease. However, the UK is now looking to develop new facilities for radioastronomy. The most important of these is a proposed global radiotelescope facility – the Square Kilometre Array (SKA) – which will probably be sited in a radio-quiet area of South Africa or Western Australia and could be operational from 2014. The consequence of this is that STFC’s investment in radio-frequency protection will focus on the UK’s role in the SKA. At the same time, in line with our policy on public-sector holdings of spectrum and the aim of incentivising efficient use by reflecting the opportunity cost of this spectrum, AIP will be phased in and payable for the continued use of channel 38 by radioastronomy.
- 5.17 These developments raised the prospect that radioastronomy use of channel 38 could cease voluntarily more quickly than would previously have been the case. In subsequent discussions, the Department for Innovation, Universities and Skills (DIUS) and HM Treasury agreed terms under which radioastronomy use of channel 38 will cease during 2012. The results of this agreement could mean that UK science will realise a considerable financial benefit as a result of placing channel 38 in the cleared award. DIUS will invite STFC to submit a proposal for investing some or all of this financial benefit in the future of UK radioastronomy.
- 5.18 Accordingly, we have developed our packaging and auction-design proposals for the cleared award on the basis that a licence for the use of channel 38 will be included in that award. This licence will need to have specific conditions that:
- sustain the protection of radioastronomy in channel 38 in the UK until 2012; and
 - sustain the protection of radioastronomy in channel 38 in neighbouring countries, which is required under the existing international framework and was confirmed at WRC-07, for as long as such protection is required.
- 5.19 In practical terms, this will limit the use of the channel itself to very low-power applications in much of Great Britain while the protection required for radioastronomy in neighbouring countries persists. However, clearing the channel in the UK will significantly enhance the usability of the adjacent channels 37 and 39 by higher-power transmission networks and hence increase the total value to society likely to be generated by using the cleared spectrum.
- 5.20 The value of this spectrum would also increase if radioastronomy use in neighbouring countries were to cease and, as a result, the protection required was reduced. We are also mindful that alternative low-power uses of this spectrum may emerge in the future, and we do not wish to preclude their ability to secure access.
- 5.21 At present, PMSE users access channel 38 with geographic restrictions to avoid harmful interference to radioastronomy. We propose to award these access rights to the band manager, but they will last only as long as we sustain the protection of radioastronomy in channel 38 in the UK (i.e. until 2012). Thereafter, access will a matter for agreement with the new licensee for channel 38.

Question 2. Do you agree with our proposal to award access rights to channel 38 that will last as long as we sustain the protection of radioastronomy in the UK?

Channels 61 and 62

- 5.22 In the DDR statement, we proposed including the interleaved spectrum available in channels 61 and 62 in the cleared award. This proposal was made in recognition of the international developments described in section 3 of this document. These

developments suggest that channels 61-69 are increasingly likely to be used for mobile services in other European countries – and possibly on a wider international scale – in the medium term. This, in turn, is more likely to result in manufacturers producing equipment that can operate over the full range of this sub-band. As technology develops, different mobile data standards beyond the current European UMTS standard for 3G are still being developed, including for Long Term Evolution (LTE) and LTE-Advanced. By 2012, when all the cleared spectrum will be available UK-wide, there may be opportunities for services based on these new standards to start to be deployed at different frequencies, including in the digital dividend.

- 5.23 Mindful of these international developments, we have conducted an initial technical study of the feasibility of operating two-way mobile services in interleaved spectrum, with particular focus on channels 61 and 62, where such services might start to operate in other parts of Europe in the medium term. We have concluded that, while the interference environment for operating mobile services in these channels would be challenging given the need to coordinate fixed transmissions with existing DTT services at various locations, interleaved spectrum could still potentially offer useful value for such services. It is perhaps unlikely that they would be attractive in isolation, instead being more likely to form a useful addition to cleared spectrum, enhancing its capacity and providing separation between the large and small cell layers.
- 5.24 The interleaved spectrum in channels 61 and 62 may also be attractive to a bidder interested in creating a sub-UK DTT multiplex in combination with either cleared spectrum or other interleaved spectrum. We therefore proposed that this spectrum should be offered at the same time and as part of the same award as the cleared spectrum.
- 5.25 We recognise that these channels are used for PMSE, but we consider that they are not essential to meet PMSE requirements and that the value of alternative uses is likely to be higher.
- 5.26 In common with the cleared spectrum, channels 61 and 62 would remain available for PMSE use in a region up to the point of DSO there.

Question 3. Do you agree with our proposal to include the interleaved spectrum in channels 61 and 62 in the cleared award?

Geographic interleaved awards

- 5.27 In parallel to this consultation, we are consulting on the award of geographic packages of interleaved spectrum suitable but not reserved for local television. Section 6 of the consultation document on those geographic interleaved awards considers the packages that we might award. Any spectrum that is so awarded will, by definition, not be included in the licence to be awarded to the band manager.
- 5.28 Separately, but also as part of that consultation, we have assessed the level of protection from new uses of that spectrum that should be given to existing DTT services. This is relevant to the band manager award as this level of protection will also dictate the amount of interleaved spectrum available for PMSE users.
- 5.29 If just one DTT transmitter covers a particular location, the coverage of that transmitter should be protected. But because there are coverage overlaps, households in some locations may have a choice of transmitters from which to receive DTT services. We have considered a variety of options for how much post-DSO protection we should give

where this is the case. These range from protecting all coverage to protecting only the best coverage (known as the digital preferred service area – DPSA).

5.30 We have proposed adopting the option that protects the following (with a higher variable increase in interference of more than 1 dB):

- the DPSA;
- the transmitter that offers the best analogue coverage; and
- the “correct” national/regional service, particularly in border areas.

5.31 The impact of this proposal would be increased availability of interleaved spectrum for PMSE users than existing assumptions allow. This means, for example, that there would be more spectrum available for PMSE use than we indicated would be the case in our statement on access to interleaved spectrum for PMSE after DSO, published on 16 January 2008.²³

5.32 A full assessment of the options for protecting DTT services after DSO can be found in section 5 of our consultation document on the geographic interleaved awards.

Question 4. Do you have any views on our proposed approach to protecting reception of DTT services?

Facilitating efficiency on DTT

5.33 We published a statement on 3 April 2008²⁴ concluding our consultation initiated on 21 November 2007²⁵ in response to a request by the Government for advice on how the MPEG-4 and DVB-T2²⁶ technologies could be introduced to the DTT platform and the potential use of regulatory powers by the Government and us to bring this about. We believe that implementing the reorganisation of DTT, which we recommended to the Government, should start in the Granada region in late 2009 and then be adopted in other regions according to the DSO timetable. However, we are concerned that this will mean that households in later regions will have to wait several years before they are able to take advantage of the new services that will be made available by this reorganisation.

5.34 We will therefore continue to explore whether it is possible to identify any additional frequencies that could be used to provide carriage of these services in other regions in the period leading up to DSO. Where identified and used, such frequencies would not be available to the band manager during that period. We aim to consult further on this issue later in 2008.

2.6 GHz

5.35 On 4 April 2008, we published a statement setting out our decision to award the spectrum at 2500-2690 MHz and at 2010-2025 MHz (together known as the 2.6 GHz award).²⁷ The former of these bands is currently used for wireless cameras, users of

²³ www.ofcom.org.uk/consult/condocs/ddr/statement/statement2/statement.pdf.

²⁴ www.ofcom.org.uk/consult/condocs/dttfuture/statement/statement.pdf.

²⁵ www.ofcom.org.uk/consult/condocs/dttfuture/dttfuture.pdf.

²⁶ DVB-T2 is an update of DVB-T, the current standard for DTT transmission that has been used in the UK since 1998. DVB-T2 is currently undergoing standardisation and is expected to give at least a 30% increase in multiplex capacity over the current standard while maintaining the same coverage.

²⁷ www.ofcom.org.uk/consult/condocs/2ghzrules/statementim/statement/statement.pdf.

which were first informed of our intention to make this spectrum available on a service- and technology-neutral basis by our predecessor, the Radiocommunications Agency (RA), in December 2002.

- 5.36 We expect this award to be completed and the new licences for this spectrum to be issued before the band manager begins operating. As a result, we will not award the spectrum at 2500-2690 MHz to the band manager.

5850-5925 MHz

- 5.37 This band is allocated for use for wireless cameras, although there is no current PMSE use. 30 MHz, at 5875-5905 MHz, has been identified as suitable for use by Intelligent Transport Systems (ITS), and the European Commission will shortly publish a Decision harmonising the use of this spectrum for safety-related ITS applications in the EU.
- 5.38 The implications of this Decision for PMSE use of the band in the UK are not yet clear. We will address this issue at a later stage of the award process and so for now make no proposal for the award of this spectrum to the band manager.

11.7-12 GHz

- 5.39 Four discrete bands between 11.7 GHz and 12 GHz are currently allocated for use for low-power camera links. PMSE shares these bands with direct-to-home (DTH) satellite television, which is likely to use the spectrum much more heavily in the coming years. This increased use will bring a greater likelihood of harmful interference from PMSE into satellite transmissions. As there is no current PMSE use of these bands and no evidence that they will be of particular importance for future PMSE use, we consider it appropriate to remove the PMSE allocation and not to award this spectrum to the band manager.

Question 5. Do you agree with our proposal not to award the bands between 11.7 GHz and 12 GHz to the band manager?

- 5.40 We do, however, propose to include the spectrum between 12.2 GHz and 12.5 GHz in the band manager award even though this will also be shared between PMSE and DTH satellite television. This is in recognition of the current significant PMSE use of this spectrum for fixed video links. We will mitigate against any increased risk of harmful interference to satellite use through the technical licence conditions for this spectrum (see section 8).

Options for spectrum that we do propose to award

- 5.41 We now consider which remaining bands allocated to PMSE we propose to award to the band manager. Our assessment recognises that some bands currently have more significance than others to PMSE users and that those other bands may have increased importance in the future. It also considers whether there is a risk of coordination failure for bands outside the digital dividend and what regard we should have to the opportunity cost of awarding these bands to the band manager.
- 5.42 We see four options for continuing to make available for PMSE use the remaining 49 Ofcom-managed bands allocated to PMSE that lie outside the digital dividend. They are:
- option 1 – contracted-out spectrum management and licensing (similar to the existing arrangements with JFMG);

- option 2 – take spectrum management and licensing in-house;
- option 3 – award licences for these bands under a process separate from the band manager award; or
- option 4 – award these bands to the band manager.

5.43 We have had regard to our four key objectives for future PMSE spectrum access in assessing which of these options offers the best approach. Our assessment follows, after which we consider whether we should divert from our general approach in respect of any bands in particular.

Avoiding disruption to PMSE users that adversely affects their ability to provide a wide range of services to citizens, consumers and business customers

5.44 All four options would facilitate continued PMSE access to the spectrum allocated to it. However, PMSE users have indicated that they would prefer to access spectrum from a single source as they have had difficulties in the past when dealing with more than one supplier of spectrum.

5.45 We also consider that PMSE users of spectrum outside the digital dividend could face the same risk of coordination failure that we identified in the DDR statement for those using the interleaved spectrum and channel 69. These users, broadly speaking, are also of a disparate nature and in many cases work within the same sector as PMSE users of interleaved spectrum. We believe it possible that the same difficulties in aggregating demand experienced by PMSE users of interleaved spectrum are likely to be faced, to some degree, by other PMSE users.

5.46 With this in mind, option 4 is stronger than the other three options. Option 2 would definitely lead to there being more than one supplier of spectrum allocated to PMSE: a combination of the band manager for the interleaved spectrum and channel 69 and us for all remaining spectrum. Options 1 and 3 could lead to this outcome, with possible combinations of the band manager for the interleaved spectrum and channel 69 and either a second band manager or a contractor for all remaining spectrum.

Facilitating participation of the PMSE sector in a market-based approach to spectrum

5.47 The band manager will be expected to expose PMSE users to a price that increasingly approaches the opportunity cost of the spectrum. At the same time, there is some evidence that PMSE demand for this spectrum will increase significantly.²⁸ Where PMSE users are looking for substitute and/or complementary bands to the interleaved spectrum and channel 69, it will be an advantage for the band manager to be able to manage any migration by having access to those other bands, even if they are not being significantly used at present.

5.48 Options 1 and 2 do not facilitate PMSE users' participation in a market-based approach to spectrum. Options 3 and 4 would each do so, to an extent determined by the detailed design of the award in question.

²⁸ See www.ofcom.org.uk/consult/condocs/ddr/reports/quotient_associates.pdf and www.ofcom.org.uk/consult/condocs/ddr/reports/report_sagentia.pdf.

Promoting the optimal use of spectrum in relation to all potential users over time

- 5.49 Option 2 scores very poorly in this respect as a command-and-control approach to spectrum allocation imparts fewer incentives than a market-based approach and so we would probably not be best placed to find the most efficient use of spectrum. Option 1 scores slightly better, although a contractor is likely to operate only within the limits that we define in advance. However, we may be able to set some incentives under the terms of the contract.
- 5.50 Options 3 and 4 both score well by placing spectrum in the hands of a licensee with incentives to realise value from its use, again to an extent determined by the detailed design of the award in question. We believe that option 4 scores better than option 3 because of the greater scope and scale that it would afford for realising efficiencies within an overall portfolio of spectrum. For example, it would allow the greater possibility of migrating PMSE users from high-cost spectrum in the digital dividend to lower-cost spectrum at other frequencies, not least by improving the band manager's ability to provide information about the availability and price of other bands to PMSE users. This is of key importance as the availability of information is one of the factors required for a market to develop.
- 5.51 A greater ability to realise efficiencies should also enable the band manager to make better use of its spectrum. We are concerned to ensure that spectrum is not precluded from its highest-value use and mindful of the opportunity cost of reserving spectrum for low-value use when there are alternatives available. We see option 4 as the most effective way of incentivising the band manager to find optimal use of the spectrum.

Avoiding the risks of regulatory and market failure

- 5.52 Options 1 and 2 score poorly against this objective as a command-and-control approach will be less likely than a market-based approach to anticipate the future demand for PMSE-allocated spectrum, whether from PMSE users themselves or from other users.
- 5.53 Options 3 and 4 both score better as, if properly incentivised, the band managers should be attentive to signals from the market and more likely to make efficient use of spectrum than if we continue to allocate and assign it. Option 4 has the additional advantage of giving a single band manager more scope to facilitate the movement of PMSE users to a market-based approach to spectrum. This would decrease the likelihood of regulatory failure by promoting more efficient use of the spectrum as users could react to any rising costs for certain bands by more readily moving to other, less expensive frequencies where appropriate. It also decreases the likelihood of market failure by ensuring that, in general, there will be a greater availability of spectrum for PMSE users.
- 5.54 Enhancing the provision of information to PMSE users about the availability of spectrum is a key factor in developing a market for PMSE spectrum access.
- 5.55 Option 3 would have the potential benefit of allowing more than one supplier of spectrum to PMSE users, creating competition for access. However, PMSE users have expressed a preference for a single band manager. We also believe that, in the case of wireless-microphone and talkback users, the limited tuning range of existing equipment would create significant difficulties in effective competition emerging.

Preferred approach to spectrum that we do propose to award

- 5.56 For all the reasons outlined above, we believe that option 4 scores well against all four objectives. Option 4 is also likely to increase the number and range of applicants for this award as opportunities to exploit wider bands are opened up. While this is not a core reason for choosing this option, we are keen to encourage applications for the licence to be awarded from as diverse a background as possible. This is therefore a desirable by-product of a decision to award all the spectrum to a single band manager.
- 5.57 We have also borne in mind PMSE users' preference for a single band manager, which again favours option 4. Option 3 could introduce competition in the upstream market for PMSE spectrum access, in theory stimulating price competition and other efficiencies. However, consistent with the position set out in the PMSE consultation document, we consider the practical scope for this to be limited because of restrictions on the tuning range of equipment and users' need to access large quantities of spectrum for special events.
- 5.58 In principle, therefore, we propose to include the remaining 49 Ofcom-managed bands allocated to PMSE but lying outside the digital dividend in the spectrum to be awarded to the band manager.

Question 6. Do you agree with our general approach of awarding the remaining 49 Ofcom-managed bands allocated to PMSE but lying outside the digital dividend to the band manager?

- 5.59 We now examine the specific characteristics of these bands to consider whether there are reasons for us to divert from our general approach in respect of any of them in particular.

Possible exceptions to including remaining Ofcom-managed bands in the award

- 5.60 The various bands have differing characteristics, particularly in the level of importance of each band to PMSE users. This importance is closely related to the level of PMSE demand for each band – the greater the importance to PMSE users, the greater their demand for that spectrum.
- 5.61 By making a broad assessment of PMSE demand for each band, we have identified three separate groups:
- key PMSE bands;
 - low-demand PMSE bands; and
 - no-demand PMSE bands.
- 5.62 We have defined a key PMSE band as one with more than 100 assignments in 2007 and a low-demand band as one with 1-99 assignments in the same year (both according to JFMG's licensing database).
- 5.63 We assess each group of bands against our four objectives for PMSE spectrum access.

Key PMSE bands

- 5.64 These are characterised by current high levels of PMSE demand. Bands in this group are:
- the interleaved spectrum and channel 69 (which we have already decided to award to the band manager);
 - some low frequencies at 47-62 MHz;
 - some VHF channels around 140 MHz;
 - talkback channels above 446 MHz;
 - wireless-camera channels at 2 GHz; and
 - fixed-link bands at 12 GHz.
- 5.65 These bands support the use of wireless microphones, talkback, fixed programme links and wireless cameras. There are currently limited identified alternative uses of these bands because of the restrictive nature of the arrangements for sharing the spectrum with primary users. The exceptions are the interleaved spectrum, which could support other uses such as DTT and business radio, and channel 69, which could support two-way mobile services depending on the extent of European harmonisation of this spectrum.
- 5.66 There is a clear case for including key PMSE bands in this award when scored against the objective of avoiding significant disruption to PMSE users. This also scores highly against our desire to avoid market failure as there is no obvious substitute spectrum for PMSE users in the short term, who would therefore be faced with an inability to operate. We consider that the high risk of coordination failure in the short term and the resultant risk of market failure outweigh the opportunity cost of awarding these bands to the band manager.
- 5.67 We have to balance these factors against promoting the optimal use of spectrum, which may be detrimentally affected by PMSE use excluding other services. We think that the optimal use of the spectrum to be awarded will be promoted by our proposal to allow non-PMSE use so long as the band manager satisfies its obligation to meet reasonable PMSE demand on FRND terms.
- 5.68 We propose to follow our preferred general approach in relation to these bands and so award them to the band manager.

Question 7. Do you agree with our proposal to award key PMSE bands to the band manager?

Channel 69

- 5.69 We note that channel 69 in isolation is of limited use for PMSE because much of the equipment used by touring companies, who benefit most from channel 69's national availability, also tunes only to channels 67 and 68. We will discuss with PMSE users whether there is alternative spectrum, comparable in quality and quantity, that could meet their long-term needs better than channel 69.

2200-2210 MHz

- 5.70 2200-2290 MHz is used for wireless cameras. Mobile satellite use has a primary allocation below this band at 2170-2200 MHz. Recent developments in the architecture of satellite systems include the use of a complementary ground component (CGC) to aid terminal reception for mobile satellite systems (MSS) in areas where the satellite signal is blocked or shadowed.
- 5.71 On 30 June 2008, the European Parliament and the Council of the EU adopted a Decision on the selection and authorisation of systems providing pan-European MSS at 2170-2200 MHz (space to Earth) and 1980-2010 MHz (Earth to space).²⁹
- 5.72 We have conducted technical analysis that indicates CGC services operating at 2200 MHz will cause interference into wireless cameras operating at 2200-2210 MHz. This is likely to significantly impair the usability of this channel for wireless cameras, although we do not propose to remove it from the spectrum to be awarded to the band manager.

2290-2300 MHz

- 5.73 We announced on 19 December 2007 that we had decided to allow temporary access to 2290-2300 MHz for use for wireless cameras, up to the point where any future award for the band was completed.³⁰ However, we have not identified any alternative long-term use of this spectrum and are mindful of our duty to secure the optimal use of spectrum and our objective of avoiding significant disruption to PMSE users. Accordingly, we propose to include this spectrum in the package to be awarded to the band manager on the same terms as other wireless-camera channels at 2 GHz.

Question 8. Do you agree with our proposal to award 2290-2300 MHz to the band manager on the same terms as other wireless-camera channels at 2 GHz?

Low-demand PMSE bands

- 5.74 There are several bands where PMSE demand is relatively low at present. These include:
- a number of VHF channels (in particular at 67-175 MHz);
 - talkback channels at 425-442 MHz; and
 - a number of bands at higher frequencies between 5 GHz and 10 GHz.
- 5.75 Again, the arrangements for sharing these bands with primary users mean that there is currently no identified alternative use in the short term. There may be some scope for fixed-link use at some of the higher frequencies, although the commercial and technical viability of this kind of use has yet to be assessed.
- 5.76 There is little case for awarding these bands to the band manager to satisfy our objective of avoiding significant disruption to PMSE users. However, there is a strong case for including low-demand PMSE bands to help facilitate a move to a market-based approach to spectrum. This is because the band manager would be better able to help PMSE users reacting to any rising costs for certain bands by moving to other, less expensive frequencies if appropriate, not least through a greater ability to provide

²⁹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:172:0015:0024:EN:PDF>.

³⁰ www.ofcom.org.uk/consult/condocs/2ghzdiscuss/temp_access/22902300.pdf.

information to PMSE users about the availability of those other bands. This is a key factor in developing a market for PMSE spectrum access.

- 5.77 We propose to follow our preferred general approach in relation to these bands and so award them to the band manager.

Question 9. Do you agree with our proposal to award low-demand PMSE bands to the band manager?

No-demand PMSE bands

- 5.78 There are some bands where there is no current PMSE use. These include:

- a number of VHF bands;
- bands at 24 GHz; and
- bands at 48 GHz.

- 5.79 There would be no disruption to PMSE users if we did not award these bands to the band manager. However, as with low-demand PMSE bands, we would potentially facilitate the move to a market-based approach for PMSE spectrum access if we did include this spectrum in the award, enhancing the band manager's ability to migrate users from higher to lower-cost spectrum where appropriate.

- 5.80 These bands also offer the greatest scope for the band manager to seek new uses, whether for PMSE or otherwise. For example, the recent use of 60 GHz wireless cameras at the Torino 2006 Winter Olympic Games suggests that there may be scope in future to develop similar camera technology in the bands at 24 GHz and 48 GHz.³¹ This could be very useful at live events. The band manager would have the incentive to develop these bands to take advantage of this scope. Even where new uses of these bands cannot currently be identified, the band manager's incentives are likely to lead to a more efficient use over time than the alternative of continued management by us.

- 5.81 We propose to follow our preferred general approach in relation to these bands and so award them to the band manager.

Question 10. Do you agree with our proposal to award no-demand PMSE bands to the band manager?

MOD-managed spectrum

- 5.82 PMSE access to the 18 MOD-managed bands has historically been negotiated by us and our predecessors. In light of the Government's spectrum reform process, including implementing the recommendations of the Independent Audit of Spectrum Holdings,³² and our review of the management of public sector spectrum,³³ the MOD is considering how it will reform its future management of spectrum. It published a consultation document on its implementation plan on 30 May 2008.³⁴

³¹ www.nhk.or.jp/str/publica/bt/en/to0026.pdf.

³² www.spectrumaudit.org.uk.

³³ www.ofcom.org.uk/consult/condocs/sfrps/sfrps.pdf.

³⁴ www.mod.uk/NR/rdonlyres/8B9CFFD1-6C36-476A-A6C3-8A3E5635DC55/0/dsm_consultation_report.pdf.

- 5.83 We published a further consultation document on 20 June 2008 concerning regulations to introduce tradable RSA in the 406.1-430 MHz band.³⁵ We are not proposing at the present time to introduce RSA in the 425-429 MHz segment of that band, which PMSE users currently share with the MOD.
- 5.84 We expect there to be keen interest from PMSE users in continued access to this spectrum and sought an assurance from the MOD that it would continue to allow PMSE use of military spectrum for as long as possible. The MOD stated in its consultation document that:
- The MOD proposes to continue to allow use of the spectrum that it manages for as long as possible and the MOD will take the longer-term use of its holdings by PMSE into consideration. . . . The MOD wishes to give the PMSE sector the assurance that spectrum access will be addressed as soon as practicable. This requires MOD to put in place new arrangements for the management of spectrum that it uses and for RSA to be established.
- 5.85 We therefore propose to include such access rights in the licence to be awarded to the band manager. The duration of these access rights is addressed in section 6. Thereafter, access to MOD-managed spectrum will be a matter for agreement with the MOD in the light of those new arrangements.

3400-3600 MHz

- 5.86 The MOD consultation document identified the 3400-3600 MHz band as a possible candidate for early release in 2009. 120 MHz of the band (at 3400-3440 MHz and 3500-3580 MHz) is allocated for use for wireless cameras.
- 5.87 On 21 May 2008, the European Commission published a Decision,³⁶ the effect of which will be to harmonise spectrum between 3400 MHz and 3800 MHz to make it available in Member States for electronic communications services. This was on a technology- and service-neutral basis suitable for broadband wireless access. The Decision must be implemented by Member States by 21 November 2008 in respect of the 3400-3600 MHz band.
- 5.88 We are currently assessing with the MOD how implementing the Decision will affect its plans to release the 3400-3600 MHz band. In the meantime, PMSE users should be aware of the uncertainty surrounding their continued access to this spectrum. We will ensure that stakeholders are kept fully informed of developments.

Licence-exempt cognitive access to interleaved spectrum

- 5.89 In the DDR statement, we considered the use of interleaved spectrum for licence-exempt applications and proposed allowing cognitive access as long as we were satisfied that it would not cause harmful interference to licensed use of the interleaved spectrum.
- 5.90 We consider here which licensed uses of the interleaved spectrum we should specifically protect from harmful interference. Responses on this issue will inform a separate consultation on licence-exempt cognitive access to the interleaved spectrum, which we expect to publish later in the year.

³⁵ www.ofcom.org.uk/consult/condocs/sfrps08/sfrps08.pdf.

³⁶ http://ec.europa.eu/information_society/policy/radio_spectrum/docs/in_transit/bwa/bwa_en.pdf.

Cognitive devices

- 5.91 A cognitive device scans the available spectrum, determines which parts of it are currently unused and, as needed, makes use of this spectrum when it has information to transmit. Cognitive devices are often described as being particularly suited for high-bandwidth services such as home and business networks, community and campus networks and municipal Wi-Fi.
- 5.92 In the DDR statement, we considered whether the interleaved spectrum was usable for low-power and/or cognitive licence-exempt devices. We considered whether the characteristics of this spectrum made it suitable for this type of use, and we examined the merits both of allowing cognitive access and of a dedicated licence-exempt allocation. We concluded that reserving spectrum for licence-exempt use would not be appropriate because of the very high opportunity cost of displacing potential licensed uses and the fact that potential licence-exempt uses could be accommodated more effectively in higher-frequency spectrum. In contrast, we concluded that cognitive devices could make flexible use of the interleaved spectrum without causing harmful interference to licensed users, depending on the development of effective spectrum-sensing technology.
- 5.93 In allowing licence-exempt cognitive access, it is important to specify a number of parameters so that cognitive devices do not interfere with licensed use. Key among these are the sensitivity of the cognitive device to detecting signals from other uses and the power levels it is allowed to transmit. These parameters will be a key element for consultation.

Specifying services to protect

- 5.94 It is generally not possible to design a cognitive device to be able to detect and avoid any service that might be deployed in the future. As a result of this, there is a need to specify in advance parameters for those services that could credibly be deployed in the interleaved spectrum and that cognitive devices should be specifically designed to avoid. It is important to strike the right balance between protecting valuable services while at the same time not imposing unnecessary restrictions on cognitive devices.
- 5.95 Equally, services that are not explicitly protected will not necessarily suffer harmful interference. Cognitive devices will tend to avoid spectrum in which they have detected signal energy. While they may be worse at detecting services to which they have not been tuned than those for which they have been specifically designed, some degree of protection will nevertheless be conferred. We also anticipate that, in most cases, harmful interference will be transitory as devices move past each other or turn on and off. For example, interference from cognitive devices to mobile television receivers may be less problematic than a reduction in signal strength experienced inside a building.
- 5.96 There is also a risk that new services will subsequently emerge that do merit protection. We considered this in the DDR statement and concluded that we needed to be mindful of the potential for cognitive access to have a negative impact on the future usability of the interleaved spectrum when specifying the parameters for this use.
- 5.97 Cognitive devices will need to ensure they do not cause harmful interference to DVB-T transmissions. We consider this should apply to licence holders irrespective of the geographic coverage of their services. We also expect to see DVB-T2 introduced in the near future and consider that this should also be protected from harmful interference.

- 5.98 Protection should also be afforded to PMSE use. This represents a broad category of technologies and applications. We suggest that protection be offered to currently available wireless microphones, in-ear monitors and talkback systems.
- 5.99 It is possible that other services, such as mobile television and two-way mobile, might be deployed in the interleaved spectrum. To determine whether to offer protection to such services, we would need to consider the likelihood of the services being deployed and the value they might bring to users compared to the reduction in value that would result from cognitive devices avoiding such services. We do not believe that there is currently enough information available to determine this quantitatively. However, we can examine the implications for cognitive devices of avoiding mobile television.
- 5.100 The key problem we envisage with cognitive devices and mobile television receivers is the possible interference caused when they are in proximity. It is possible that a mobile television receiver and a cognitive device might be within a few metres of each other (e.g. in a railway carriage). In this situation, modelling shows that even if the cognitive device detects a mobile television transmission and avoids using the channel as well as adjacent channels, interference can still result. This is because the out-of-band filtering of the mobile television handset may be insufficient to remove it. Only by restricting the transmit power of the cognitive device to levels of around 1 mW can interference be avoided. Such a low transmit power level would, in our view, render the cognitive device of little value.
- 5.101 Broadly, our conclusions are that mobile television and cognitive devices cannot coexist in the same spectrum unless the out-of-band performance of mobile television handsets is substantially improved above current specifications by at least 20 dB. Hence, if we conclude that mobile television transmissions in the interleaved spectrum should be protected, we effectively prevent the use of cognitive devices. We should, therefore, only protect mobile television if we have reasonable expectations that it will be deployed and will provide significant consumer value. We plan to consider this in our forthcoming consultation on allowing licence-exempt cognitive access to the interleaved spectrum.

Question 11. Are there any other types of DTT transmission that should be protected from potential cognitive devices or other factors that we should take into account?

Question 12. Are there any potential future PMSE applications other than currently available wireless microphones, in-ear monitors and talkback systems that you consider should be protected from potential cognitive devices?

Question 13. Is there sufficient evidence to require protection for other services such as mobile television, bearing in mind the potentially negative implications of such protection for deploying cognitive devices?

Next steps

- 5.102 In the light of responses to this consultation document and the consultation document on the geographic interleaved awards, we will form a judgement on the services that we believe should be explicitly protected from harmful interference from licence-exempt cognitive devices in the interleaved spectrum. We will issue a consultation later in the year detailing the required parameters for cognitive devices in order to achieve this.

Temporary access to the cleared spectrum

- 5.103 In October 2007, we set out our decision to allow temporary PMSE use of channels 63-68 in the regions where DSO will take place before the end of 2009, up to the point where new users need access to the spectrum.³⁷ We indicated that we would give six months' notice before ending temporary access to these channels.
- 5.104 We believe that it may now be possible for us to increase the notice period by another six months, giving PMSE users a 12-month notice period in total. We may also be able to extend temporary access for PMSE to channels 31-40, with a similar notice period.
- 5.105 We would envisage exercising this notice after the cleared award has been concluded if we are requested to do by the licensees successful in the award.
- 5.106 There are two reasons for considering the case for a longer notice period:
- there is a potential benefit to PMSE users from having greater notice of the need to quit channels 63-68 in particular. This is because it could help them to phase the process of migrating to new frequencies and any equipment purchase beyond just like-for-like replacements; and
 - the cost to potential providers of new services in the cleared spectrum may be very low or negligible as it may be unlikely that they will offer commercial services in the first 12 months after the award. This period may instead be used for further developing business plans and/or building physical infrastructure.

Question 14. Do you have any views on the appropriate notice period for temporary PMSE access to channels 63-68 and/or on whether we should extend temporary access to channels 31-40?

Conclusions

- 5.107 We are committed to moving to a market-based approach to spectrum management. The band manager will be operating within such an environment, albeit with obligations to PMSE users, and is likely to be able to respond to signals from the market with greater efficiency than we are. We believe that our approach will significantly reduce the risks of coordination failure and help us to meet our key objective of avoiding the risks of regulatory and market failure.
- 5.108 We therefore propose to award to the band manager all bands currently allocated to PMSE that we manage with the exception of the following:
- channel 38 (after 2012);
 - channels 61 and 62 (after DSO);
 - spectrum subject to the geographic interleaved awards;
 - spectrum that could be used to provide carriage of new services made available by introducing MPEG-4 and DVB-T2 to the DTT platform in regions in the period leading up to DSO;
 - 2500-2690 MHz; and

³⁷ www.ofcom.org.uk/consult/condocs/pmse/statement/statement.pdf.

- 11.7-12 GHz.

5.109 In terms of spectrum managed by the MOD, we propose to include access rights to all bands currently used for PMSE until such time as the MOD puts in place new arrangements for managing this spectrum.

5.110 We will address the 5850-5925 MHz band at a later stage of the award when the implications of the relevant European Commission Decision become clearer.

Section 6

Licence duration

Introduction

- 6.1 In the DDR statement, we proposed that the licence to be awarded to the band manager in respect of the interleaved spectrum and channel 69 should have indefinite duration, with an initial period during which we could not vary or revoke the licence on spectrum-management grounds.
- 6.2 This section sets out our detailed proposals for the duration of the band manager's licence. It looks specifically at:
- licence duration; and
 - length of notice period.
- 6.3 In making our assessment, we have had regard to several factors that we believe to be important to meeting our key objectives for future PMSE access to spectrum.
- 6.4 In the case of licence duration, we have had regard to the need for us to promote the optimal use of spectrum by avoiding, where possible, its being returned by the band manager after a set period of time, which is likely to be arbitrary in the context of operating its business.
- 6.5 In the case of the notice period, we have had specific regard to balancing the following factors:
- the band manager's need for sufficient certainty in making business investments;
 - the band manager's need for time to implement strategies for increasing efficiency in the use of spectrum; and
 - our need to intervene where we believe that there are significant risks of disruption to PMSE users.
- 6.6 For low and no-demand PMSE bands, we have based the appropriate notice period on the precedent set by past awards.
- 6.7 Overall, we consider that a shorter notice period to enable us to intervene more quickly is more appropriate where there is a greater risk of significant disruption to PMSE users.

Licence duration

- 6.8 It was proposed in the Spectrum Framework Review: Implementation Plan that new licences to be awarded by auction should generally have an indefinite term with an initial period.³⁸ During the initial period, the grounds for variation or revocation would not include a general right to do so on spectrum-management grounds. After the end of the initial period, the grounds for revocation would include such a right, subject to a minimum notice period of five years. We also proposed that notice of variation or

³⁸ www.ofcom.org.uk/consult/condocs/sfrip/sfip/sfr-plan.pdf.

revocation for spectrum-management reasons could be given to take effect the day after the expiry of the initial period.

- 6.9 The aim of proposing an indefinite duration was to give the licensee the opportunity to continue operating its business beyond the initial period. However, during this period, we would be able to recover the spectrum by serving a notice of revocation in a similar manner to many other spectrum licences if this step was justified on spectrum-management grounds. In addition, we would reserve the right to charge AIP after this period to incentivise efficient use of the spectrum.
- 6.10 We consider that there are a number of reasons why licences with an indefinite duration are likely to promote optimal use of spectrum and other relevant objectives, including promoting competition.
- 6.11 In particular, awarding licences with an indefinite duration reduces the need for regulatory intervention to reassign spectrum at the end of the licence term. One disadvantage of fixed-duration licences is that, at the end of the licence term, the licence expires and so the rights to use it must be returned to the regulator unless any other action has been taken. This may result in a period during which the spectrum remains unused as the regulator must go through a process to reassign those rights. Furthermore, incentives to invest closer to the end of the licence duration are significantly reduced given that electronic communications networks generally require continual investment. This lack of investment could result in detriment to citizens and consumers. The alternative of licences with an indefinite duration removes the requirement for return to the regulator, removes the risk of discouraging investment and creates additional opportunities for the market to secure the efficient use of the spectrum, particularly in the presence of spectrum trading.
- 6.12 We consider that, as a matter of principle, it is preferable to look to market mechanisms to promote the efficient use of resources rather than regulatory intervention unless the case for such intervention is clear. To date, we have not identified a general need for us to recover spectrum at the end of the initial period in relation to any of our spectrum awards.
- 6.13 We consider that there are likely to be a number of other advantages to adopting the general approach proposed above. In particular, reassignment by the regulator typically takes significant time and resource. The spectrum may also lie idle for a period as the regulator prepares for reassignment. While it may be possible to reduce this problem through the use of overlay auctions, the approach of an indefinite duration together with spectrum trading seem likely to offer a simpler and less costly way of ensuring the spectrum is used efficiently.
- 6.14 We believe these arguments apply equally in principle to the licence to be awarded by beauty contest to the band manager. The retention of powers to vary or revoke on spectrum-management grounds provides a mechanism allowing regulatory intervention if this is justified.

Question 15. Do you agree with our proposal that the licence to be awarded should have an indefinite duration?

Initial period and notice period

- 6.15 The aim of our proposal for the initial period of a licence was to provide licensees with a term during which they would have high security of tenure and grounds for variation or revocation would be limited to a narrowly defined set of conditions. The duration of

the initial period should be linked to a reasonable view of the time required to efficiently earn an appropriate return on the investment anticipated for efficient use(s) of the spectrum and take into account any other factors that are relevant.

- 6.16 In the DDR statement, we indicated that we favoured such an approach for the licence to be awarded to the band manager for interleaved spectrum and channel 69. We suggested that an initial period of 10 years would be appropriate, recognising the needs of the band manager to recoup any investments as well as realise efficiency strategies.
- 6.17 However, the additional spectrum that we now propose to award to the band manager requires us to reconsider the appropriate initial period in the light of the circumstances relevant to those bands. We believe that these point to a number of different approaches, as discussed below.

Ofcom-managed spectrum

Bands currently used for PMSE

- 6.18 We consider that there is a strong case for not applying an initial period to the licence duration for bands currently used for PMSE and instead relying only on a minimum notice period. The reasons for this are as follows:
- we are keen to provide protection to PMSE users at a time of significant change and uncertainty. Part of this protection should include the ability for us to intervene promptly if there is a serious risk of damage to PMSE users as a result of the band manager's actions. We do not see this as a likely scenario, but it is important that the power to intervene exists if a problem does emerge;
 - this award is novel and gives rise to uncertainties about how the band manager will operate in practice. While we believe that our proposals will lead to an improved mechanism for PMSE users to access spectrum, we are mindful of the risk of regulatory failure and the need to intervene if this risk materialises; and
 - the band manager will be able to request a licence variation from us to increase the notice period where this would facilitate the use of its spectrum by a third party. This could relate equally to use for PMSE or for another use (in which case the band manager would need to show to our satisfaction that it could continue to meet its obligations toward PMSE users).
- 6.19 The spectrum to which, accordingly, we do not propose to apply an initial period, relying instead on a minimum notice period, is that identified in section 5 as being key to PMSE users or where PMSE demand is low at present, namely:
- the interleaved spectrum and channel 69;
 - some low frequencies at 47-62 MHz;
 - a number of VHF channels (in particular at 67-175 MHz);
 - talkback channels above 425 MHz;
 - wireless-camera channels at 2 GHz (including 2290-2300 MHz);

- a number of bands at higher frequencies between 5 GHz and 10 GHz (with the exception of 5850-5925 MHz); and
 - fixed-link bands at 12 GHz;
- 6.20 For the same reasons, we believe that there should be a relatively short notice period for varying or revoking the band manager's licence on spectrum-management grounds in respect of these bands. We consider that the disruption to PMSE users of the band manager not fulfilling its obligations in respect of these bands would be high. We are mindful of the need to give sufficient business certainty to the band manager and for it to have time to develop strategies to realise efficiencies. But we are also aware of the need to ensure PMSE users receive sufficient protection against the possibility that the band manager does not meet its obligations. We believe that this latter consideration outweighs the others in this case.
- 6.21 We therefore consider that, for bands that are currently used for PMSE, we should set a notice period that is relatively short to give users confidence that we will be able to intervene if the band manager fails to meet its obligations. With this in mind, we propose that the notice period should be set at one year. This would not be an unusual notice period for us to apply where licences are, for example, non-tradable.
- 6.22 We recognise that it will be important to allow the new institutional arrangements for PMSE spectrum access to bed down and that there may be some initial problems. Our preference would be for the band manager to resolve any such problems itself, with regulatory intervention only being used as a backstop measure. We would use our powers to vary or revoke the band manager's licence only as a last resort and in exceptional circumstances.
- 6.23 Details of when and how we propose to give notice to vary or revoke the band manager's licence are given in section 9.

Question 16. Do you agree with our proposal that the licence to be awarded in respect of bands currently used for PMSE should be subject to no initial period?

Question 17. Do you agree with our proposal that the licence to be awarded in respect of bands currently used for PMSE should be subject to a notice period for variation or revocation on spectrum-management grounds of one year?

Question 18. Do you agree with our proposed approach to allowing the new institutional arrangements for PMSE spectrum access to bed down?

Bands where there is no current PMSE use

- 6.24 We again do not propose to apply an initial period to the licence duration for bands where there is no current PMSE use. This is because we believe that security of tenure can effectively be provided simply by applying a longer notice period than the one year proposed above for bands currently used for PMSE.
- 6.25 In assessing this notice period, we have considered what would provide the band manager with a reasonable opportunity to make an appropriate return on efficient investment without unnecessary regulatory risk, particularly in recognition of its obligations toward PMSE users and our key objectives for future PMSE spectrum access. We have had particular regard to providing sufficient time to the band manager to develop these bands to facilitate increased PMSE or non-PMSE use. This would be

in keeping with our objective of promoting the optimal use of spectrum in relation to all potential users.

- 6.26 It is standard policy for us to apply five-year notice periods to tradable licences. In this case, we consider that such a notice period would provide the band manager with sufficient time to implement measures to develop the spectrum for innovative PMSE use or other use. We also believe that this period would give us sufficient flexibility to intervene in a timely fashion if we determined that the spectrum was not being used efficiently and there was a significant risk of regulatory failure if this situation persisted in the longer term.
- 6.27 We therefore propose a five-year notice period for varying or revoking the band manager's licence on spectrum-management grounds in respect of bands with no current PMSE use. This will enable us to intervene where we have identified, possibly through the formal reviews of the band manager's performance proposed in section 9, that the optimal use of spectrum is not being secured and that there is significant risk of regulatory failure. Again, details of when and how we would take such a step are given in section 9.

Question 19. Do you agree with our proposal that the licence to be awarded in respect of bands with no current PMSE use should be subject to no initial period?

Question 20. Do you agree with our proposal that the licence to be awarded in respect of bands with no current PMSE use should be subject to a notice period for variation or revocation on spectrum-management grounds of five years?

MOD-managed spectrum

- 6.28 The MOD will issue a statement later in 2008 announcing its conclusions on UK defence-spectrum management. We are not, therefore, able to set out specific notice periods for PMSE access to the bands that it manages at present. We will address this at a later stage of the award process following further discussions with the MOD.

Varying or revoking the band manager's licence during the notice period

- 6.29 We propose that we will have the ability to vary or revoke the band manager's licence during the relevant notice period for the following reasons:
- with the band manager's consent;
 - for non-payment or late payment of the licence fee;
 - if there has been a breach of any of the terms of the licence;
 - if the band manager has not complied with any requirement of any relevant trading regulations;
 - if the band manager has not complied with the regulations under which the licence was awarded;
 - if the band manager is wound-up or an administrator or receiver is appointed;
 - in the interests of national security or for the purposes of complying with a Community obligation of the UK or with any international agreement or arrangements to which the UK is party; and

- for the purpose of complying with a Direction by the Secretary of State under section 5 or section 156 of the Communications Act.

Question 21. Do you agree with our proposals for varying or revoking the band manager's licence during the notice period?

Bands that might need different consideration

- 6.30 Our proposals in this section focus on the arrangements that will exist once the band manager has started operating. We currently envisage this will happen by spring 2010.
- 6.31 We are aware that some PMSE users may want to make decisions about long-term investment in future spectrum access before this time. We are concerned that such decisions promoting spectrum efficiency (e.g. to purchase new equipment able to use currently underutilised bands) may be frustrated if users have to wait to agree access terms with the band manager – especially if the band manager first needs to obtain a licence variation from us to be able to offer sufficient security of access.
- 6.32 We are therefore interested to know if there are bands where PMSE users require earlier certainty about longer-term access in the interests of promoting spectrum efficiency than our timetable for the band manager award allows.

Question 22. Are there bands where PMSE users require earlier certainty about longer-term access in the interests of promoting spectrum efficiency than our timetable for the band manager award allows?

Conclusions

- 6.33 We propose taking the approach set out in table 2 to licence duration and notice periods for the spectrum that we propose to award to the band manager.

Table 2. Proposed licence duration and notice periods

Bands	Licence duration	Notice period
Bands currently used for PMSE		
Interleaved spectrum and channel 69 Some low frequencies at 47-62 MHz A number of VHF channels (in particular at 67-175 MHz) Talkback channels above 425 MHz Wireless-camera channels at 2 GHz (including 2290-2300 MHz) A number of bands at higher frequencies between 5 GHz and 10 GHz (with the exception of 5850-5925 MHz) Fixed-link bands at 12 GHz	Indefinite	One year

Bands	Licence duration	Notice period
Bands where there is no current PMSE use		
A number of VHF bands Bands at 24 GHz Bands at 48 GHz	Indefinite	Five years
MOD-managed spectrum		
All	Temporary	To be agreed with MOD

Section 7

Award design and process

Introduction

- 7.1 We said in the DDR statement that we would identify the band manager via a beauty contest. This section sets out our proposals for:
- the selection criteria by which we will assess applications for the licence to be awarded; and
 - how we will approach that assessment in a way that is objective, transparent, non-discriminatory and proportionate.

Selection criteria

- 7.2 The DDR statement noted that the selection criteria should favour applicants with the technical and managerial ability to meet the needs of PMSE users, with interests aligned with those of PMSE users and with incentives to secure optimal use of the spectrum in the interests of all users.
- 7.3 We continue to believe that these are the appropriate foundations for assessing applications for the licence to be awarded. We therefore propose that we will have regard to the following matters – spelled out in more detail below – in determining to whom to award the licence:
- the extent to which each of the applicants is likely to secure efficient use of the spectrum to be awarded for both PMSE and other uses;
 - the extent to which each of the applicants demonstrates an understanding of, and a commitment to, the needs of PMSE users; and
 - the financial, managerial and technical ability of each of the applicants to establish and maintain efficient systems and procedures to secure efficient use of the spectrum to be awarded for both PMSE and other uses.
- 7.4 These proposed criteria reflect our key objectives for future PMSE access to spectrum.
- 7.5 We will need to make regulations under the Wireless Telegraphy Act to give effect to the selection criteria for the band manager award. Before we do this, we will consult on a draft of the regulations, giving stakeholders a further opportunity to comment on the selection criteria.

Selection criterion 1: efficient use of spectrum

- 7.6 The band manager should be able to respond to the incentives given to it to improve the efficient use of spectrum. We will therefore expect applicants to demonstrate that they have the ability or potential to manage the spectrum efficiently for both PMSE use and any other use that they identify (subject to meeting the obligations toward PMSE users, discussed in section 9).
- 7.7 We propose to require applicants for the licence to be awarded to demonstrate the following:

- technical knowledge of the characteristics of the spectrum to be awarded;
- plans for making more efficient use of the spectrum, with specific reference to a variety of services and technologies;
- plans for making use of other spectrum and how this will lead to more efficient use of spectrum in general;
- plans for moving PMSE users to a market-based approach to spectrum access; and
- plans for communicating with key stakeholders (in particular us and specific users and their representatives).

Selection criterion 2: understanding of PMSE users

- 7.8 In support of the band manager's obligations toward PMSE users, applicants will need to demonstrate that they will have due regard to the needs of this sector.
- 7.9 We propose to require applicants for the licence to be awarded to demonstrate the following:
- knowledge of the PMSE sector (both professional and community users), the equipment it uses, its operational characteristics and the major issues that affect it now and are likely to affect it in the future;
 - an approach to spectrum access for PMSE at major events, including advance communication with us where problems are foreseen;
 - appreciation of the issue of unauthorised spectrum access by PMSE users and plans for helping to address this; and
 - plans for communicating specifically with PMSE users.

Selection criterion 3: operational ability

- 7.10 We propose that each applicant will need to demonstrate that it operates or will be able to operate in the future on a sound financial basis, with the managerial and technical expertise to meet the conditions of the licence to be awarded.
- 7.11 We propose to require applicants for the licence to be awarded to provide evidence of the following:
- a detailed business plan explaining how delivery of the commitments given in the application will be resourced;
 - operational information (e.g. staffing levels);
 - a detailed description of both internal and third-party dispute-resolution procedures (see section 9);
 - plans of pricing structures and charges for PMSE use of the spectrum to be awarded;
 - proposed service levels for PMSE users, including key performance indicators;

- a detailed description of governance, particularly decision-making and authority; and
- information (e.g. recent accounts or funding commitments) demonstrating long-term financial viability.

Question 23. Do you agree with our proposals for the three selection criteria by which we will assess applications for the licence to be awarded?

Enshrining commitments as licence conditions

- 7.12 We will expect applicants to make detailed proposals for meeting the three selection criteria set out above. In particular, these should include firm commitments on:
- pricing structures and charges for PMSE users in light of our policy that prices should be FRND;
 - providing PMSE users with access to spectrum for which they are prepared to pay ;
 - service levels that PMSE users can expect to receive, including key performance indicators;
 - providing us with sufficient notice of intent to return spectrum (either part or all of the licence);
 - spectrum access for PMSE at major events; and
 - resolving disputes with PMSE users, both through internal procedures and using independent ADR .
- 7.13 We expect the selection criteria to be rigorous in identifying applicants with credible plans for addressing these issues. But we also want to minimise the risk that they occur in practice. To achieve this, we propose to enshrine the commitments made by the successful applicant in the licence awarded to it.
- 7.14 These commitments all condition how the band manager will behave toward PMSE users and do not address how it will promote the optimal use of spectrum. We do not consider it necessary to seek and enforce commitments in this regard as we believe that our proposals to introduce AIP and allow the band manager to make the spectrum to be awarded available for non-PMSE uses should provide sufficient commercial incentive for the band manager to realise any efficiencies that it identifies. However, applicants should be aware that any additional commitments they make that are material to their being selected as the band manager will also be enshrined in the licence that will be awarded.
- 7.15 We will be more specific about the form these commitments should take in the guidance notes accompanying the Invitation to Apply (ITA) that we will issue later in the award process.

Question 24. Do you agree with our proposal to enshrine the commitments to PMSE users made by the successful applicant in the licence awarded to it?

Our approach to assessing applications

Scoring applications

- 7.16 Each application will first be scored against selection criteria 1 and 2, which deal with efficient use of spectrum and commitment to PMSE users.
- 7.17 We do not propose to weight either criterion higher than the other, but we will expect the successful application to score well against both rather than rely heavily on just one (i.e. being strongly PMSE aligned but with little evidence of ability to manage spectrum efficiently or vice versa). This will ensure that we select a band manager that is well equipped to meet all four of our key objectives for future PMSE spectrum access and promote optimal use of the spectrum to be awarded.
- 7.18 In assessing applications against selection criterion 3, which deals with operational ability, we propose to assess how likely we believe they are to be realised in light of the financial, managerial and technical capabilities demonstrated. We will be interested not in how well resourced an applicant is but rather whether it is adequately resourced to meet the commitments it makes in its application.

Providing information to applicants

- 7.19 We will publish relevant information to enable prospective applicants to decide whether to take part in the award. This will include publication of an information memorandum (IM) setting out details of the licence to be awarded.

Making a decision

- 7.20 Once the necessary regulations have been made, we will publish the ITA for the licence to be awarded. This will specify the information that we require from applicants and the closing date for making applications.
- 7.21 We propose that authority to make the award decision should be delegated from the Ofcom Board to a specially composed Ofcom committee. The members of the committee would be drawn from executive colleagues with appropriate expertise and at least one non-executive member of the Board.
- 7.22 We propose that the committee should be assisted in its assessment by briefing material prepared by executive colleagues who are not members of the committee. In preparing this material, those colleagues may ask follow-up questions of applicants to clarify any aspects of their applications that they consider unclear.
- 7.23 As part of the assessment process, we propose to publish non-confidential sections of applications (and any non-confidential follow-up questions and responses) on our website and invite representations from interested third parties. We would expect these to include, but not be limited to, PMSE users and other prospective users of the spectrum to be awarded. This would meet the expressed wishes of some PMSE users to be involved in the selection process.
- 7.24 We propose to publish our reasons for awarding the licence to the successful applicant. We seek views on whether we should also publish the reasons why other applicants were not successful. This would make the award decision more transparent but may not be welcomed by unsuccessful applicants if, for example, our reasons included criticisms of aspects of their application or cast doubt on their ability to deliver their proposed business plan.

Where no application is of sufficient quality to make an award

- 7.25 In the event that we consider no application satisfactorily meets the selection criteria, we will not make an award. We will then reconsider the future arrangements for PMSE access to the spectrum to be awarded. We might, for example, extend the existing institutional arrangements for PMSE access to spectrum. This would fulfil our commitment to avoiding significant disruption to PMSE users.

Question 25. Do you agree with our proposed approach to assessing applications?

Conclusions

- 7.26 This section has set out:
- the three selection criteria that we propose to use in deciding the successful applicant for this award;
 - the specific areas where we will be looking for evidence and commitments to support applications;
 - our proposal to enshrine the successful applicant's commitments in the licence awarded to it;
 - our proposed approach to the scoring of applications; and
 - the process by which we propose to assess applications and make the award decision.

Section 8

Licence conditions

Introduction

- 8.1 This section sets out our proposals for the technical licence conditions that will determine how equipment using the spectrum to be awarded may do so. It also considers non-technical licence conditions, in particular those that relate to the AIP-based licence fee, DTT multiplex issues and the provision of information to promote efficient use of spectrum.

Technical licence conditions

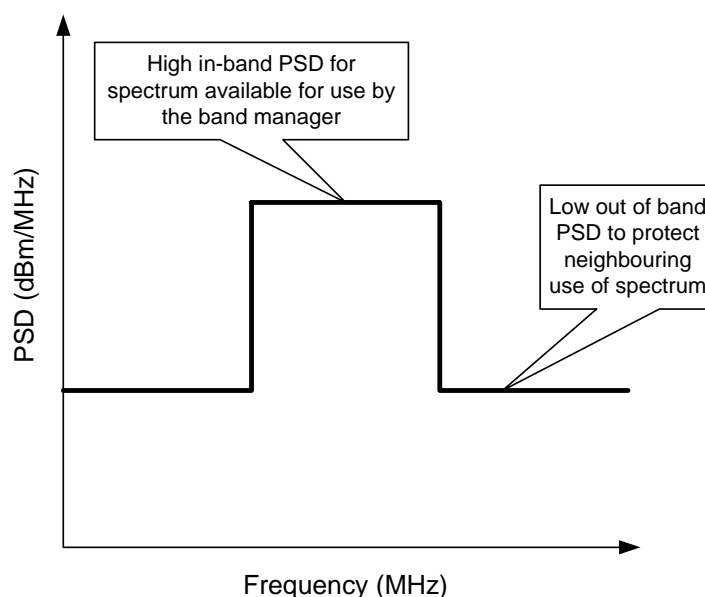
Existing arrangements

- 8.2 JFMG is currently authorised under the Contracting Out (Functions Relating to Wireless Telegraphy) Order to license PMSE use of spectrum providing that this function is exercised in accordance with, and to the extent specified in, the service contract between it and us.
- 8.3 Existing arrangements, including baseline technical parameters for PMSE spectrum access, have been established and developed over many years. It is worth noting that many of these arrangements are based on the assumption of low-level PMSE use, resulting in an acceptably low probability of harmful interference to the primary user.

The block-edge mask approach to authorising use of spectrum

- 8.4 This is one of the most straightforward approaches that can be adopted when defining technical licence conditions. The BEM describes the maximum emissions that a user's equipment may produce. These emissions can be defined either as a power (measured at the transmitting equipment's antenna terminal) or as an effective radiated power (derived from field-strength measurements).
- 8.5 A further refinement of this approach is to use power spectral density rather than power since this avoids the need to specify transmitter bandwidth and results in a more flexible, technology-neutral condition. Figure 2 is an example of a simple BEM.

Figure 2. Simple block-edge mask



- 8.6 To protect other users sharing the same spectrum, it is usually also necessary to impose geographic restrictions on transmissions. These “no-go” areas may be described by simple geometric shapes such as circles (typically used to protect point locations such as military installations) or as complex regions (used to protect DTT reception in the interleaved spectrum).
- 8.7 It may also be necessary to specify the maximum density of transmitters that may be deployed in order to control the maximum aggregate level of interference that other authorised spectrum users will receive.
- 8.8 Using the BEM approach to describe the technical licence conditions relevant to this award appears to us to offer a number of benefits:
- it is readily understood by the stakeholders likely to be particularly affected, and it is simple to determine whether transmitting equipment is compliant;
 - it does not require the transmitter bandwidth, modulation or channel plan to be defined and, as such, represents a technology-neutral basis for authorising use of spectrum;
 - it would be compatible with continued PMSE use of spectrum; and
 - it will result in lower transaction costs for the band manager, and therefore the band manager’s customers, due to its relative simplicity.

Spectrum usage rights

- 8.9 We first consulted on the concept of SURs on 12 April 2006.³⁹ They are designed to support our general policy of liberalising the use of spectrum.
- 8.10 Whereas the BEM approach describes the power/frequency envelope that transmitting equipment may produce, the SUR approach places restrictions on the maximum level of interference that may be delivered into other authorised spectrum users’ receiving

³⁹ www.ofcom.org.uk/consult/condocs/sur/spur.pdf.

equipment. This provides the licensee with the greatest possible freedom to determine the use of its spectrum.

8.11 An example of a SUR is provided below:

- the aggregate out-of-band power flux density at a height H above ground level should not exceed X dBW/m²/MHz at more than Z% of locations in a test area.

8.12 Using the SUR approach to describe the technical licence conditions relevant to this award appears to us to offer a number of benefits:

- it directly controls the level of interference caused to other authorised spectrum users; and
- it provides the greatest possible level of flexibility to the licensee to determine how to use its spectrum. For example, restrictions on transmitter density, of the form described above for the BEM approach, would not be required. This, coupled with the ability to trade spectrum, would result in the efficient use of spectrum in the long term.

8.13 But the price of this increased flexibility is increased complexity because, in order to determine received interference levels, it is necessary to model radio-wave propagation and typical usage scenarios.

Our proposed approach

8.14 Because of existing patterns of use and the measures proposed in this consultation document to meet our objective of avoiding significant disruption to PMSE users, we believe that non-PMSE use of the spectrum to be awarded will initially be quite low. Because of this, it is our view that the benefits of increased flexibility that the SUR approach offers could be limited in the short term.

8.15 Furthermore, we note that most PMSE use of spectrum tends to be short term and that the density of use in some locations can be very low. These characteristics mean that it would be difficult to apply the methodology described in the Spectrum Usage Rights Guide⁴⁰ to this use of spectrum because:

- the methodology has been designed for stable and relatively dense networks and requires the cumulative impact of at least 10 base stations to be modelled. It would be difficult to apply this methodology to sparse PMSE use of spectrum in remote locations; and
- the transient nature of PMSE use would make it difficult for practical measurements to be used to verify that the band manager was correctly adhering to its SURs.

8.16 We therefore propose to use the BEM approach to determine the technical licence conditions relevant to this award and to base these masks broadly on existing arrangements for PMSE spectrum access.

8.17 We believe that this approach would:

- minimise the regulatory burden for both the band manager and its customers;

⁴⁰ www.ofcom.org.uk/radiocomms/isu/sursguide/sursguide.pdf.

- be compatible with our objective of avoiding significant disruption to PMSE users; and still
- allow more flexible use of the spectrum to be awarded than the existing arrangements.

8.18 In future, the band manager may seek to vary its licence in favour of more flexible, SUR-based technical licence conditions in respect of certain bands. This could support a wider range of uses of that spectrum and promote trading to third parties. Although we cannot decide in advance how we would treat any particular variation request, in general we would expect to consider such requests favourably providing the band manager had met its obligations to PMSE users effectively and its proposals were consistent with our key objectives for future PMSE spectrum access.

8.19 Within this general context, we note that there has been some interest in the use of the interleaved spectrum for providing additional television services. In light of this, the band manager may seek to vary the relevant technical licence conditions to supplement them with DTT-centric BEMs in respect of certain frequencies at certain locations (e.g. transmitter sites). These BEMs would be broadly equivalent to the PMSE-centric BEMs because, while they would permit the use of higher transmitter powers required for broadcasting at certain locations, they would result in broadly the same level of aggregate interference to existing DTT services in the surrounding area. As set out in our consultation document on the geographic interleaved awards, we see benefit in the band manager providing access to its spectrum for these services and would expect to consider any licence-variation requests favourably given the same circumstances outlined above.

8.20 As such variations could constitute an important change to the arrangements for PMSE spectrum access that we are introducing, we may wish to assess their potential impact on users and/or consult before agreeing to them.

8.21 We believe that our proposed approach to technical licence conditions strikes the right balance between avoiding significant disruption to PMSE users in the medium term and allowing more flexible and efficient use of the spectrum to be awarded in the longer term.

Question 26. Do you agree with our proposal to use the block-edge mask approach to determine the technical licence conditions relevant to this award and to base these masks broadly on existing arrangements for PMSE spectrum access?

8.22 The IM published alongside the ITA will set out the details of the licence to be awarded in sufficient detail to enable candidate applicants to determine whether they wish to enter the award process. The IM will include a draft copy of the licence to be awarded, including the technical licence conditions.

Non-technical licence conditions

Licence fee

8.23 Current PMSE licence fees have been designed to recover administrative costs – namely, the costs of our contract with JFMG (although we currently do not, in practice, recover the full administrative cost). This cost-recovery approach to determining licence fees does little to incentivise efficient spectrum use because it does not signal the opportunity cost of the spectrum to users. In line with our general policy for spectrum awarded other than by auction, we propose to reflect AIP in the licence fee paid by the

band manager. This means the fee charged for access to the spectrum awarded to the band manager will reflect the loss of its availability to alternative uses or to other PMSE users in addition to its costs of administration.

- 8.24 We believe that moving to an AIP approach to spectrum pricing will, in the long term, help to satisfy our objectives to:
- facilitate participation of the PMSE sector in a market-based approach to spectrum; and
 - promote the optimal use of spectrum in relation to all potential users.
- 8.25 Paying an AIP-based fee for spectrum incentivises users to use it more efficiently. This is, in part, because it will motivate users to assess how much value their existing spectrum access generates for them and whether they could reduce their costs by using spectrum more efficiently. If the value of the spectrum to a user is less than the fee to be paid, that user will be keen to reduce its spectrum use. This spectrum, in turn, may become available to other users. We envisage that spectrum pricing on this basis will help to ensure that those users that value spectrum most gain access to the resource.
- 8.26 We expect that moving to an AIP approach to setting the band manager's licence fee will create such incentives for both the band manager and PMSE users of its spectrum. In the case of the band manager, we would expect it to seek to transfer access to its spectrum to users who will get more value out of it or to return the spectrum to us to reassign.

Determining the price of PMSE spectrum access

- 8.27 The general approach to setting spectrum prices to incentivise efficient use, as described above, has been developed over a number of years. Since 1998, first the RA and now we have had the legal power to set fees higher than administrative costs for this purpose. Our general approach for determining the economic value of spectrum to be reflected in AIP is based on the methodology reviewed by NERA and Smith System and published on 29 July 1998⁴¹ and refined subsequently in a report by Indepen, Aegis and Warwick Business School published on 2 March 2004.⁴²
- 8.28 We consider the opportunity cost of the use of spectrum, in terms of what other users who have been denied access would have been prepared to pay, as a measure of the marginal value of that spectrum. This means that, in order to estimate the opportunity cost of spectrum, we need to investigate the value generated by both existing and other potential uses of the spectrum. These values vary band by band. We therefore need to assess the opportunity cost of each band. Annex 6 describes in more detail our methodology for deriving opportunity costs of PMSE spectrum access.
- 8.29 Setting spectrum prices to reflect the opportunity costs of existing or potential use is particularly appropriate where spectrum supply would otherwise be insufficient to meet the demand from all interested parties. This demand could come from existing as well as potential new users. In such cases, we expect the spectrum to have a positive opportunity cost, and we can signal this through an AIP component in the licence fee.

⁴¹ www.ofcom.org.uk/static/archive/ra/topics/spectrum-price/documents/spec_rev/ha129.doc.

⁴² www.ofcom.org.uk/research/radiocomms/reports/independent_review/spectrum_pricing.pdf.

- 8.30 When we anticipate demand from all interested parties to be low or easy to satisfy from the available spectrum at low or zero prices, we expect the opportunity cost to be correspondingly low or zero. Where opportunity costs are sufficiently close to zero, we tend to set the licence fee at a level to cover administrative costs only.
- 8.31 In response to a recommendation of the Independent Audit of Spectrum Holdings, we generally attempt to set AIP for licence fees at levels that reflect the marginal value of spectrum based on its opportunity cost, as set out above, as much as possible. However, in setting the level of the band manager's licence fee, we will also have regard to our objectives for future PMSE spectrum access besides spectrum efficiency. In particular, we will assess the extent, if any, to which changes in the band manager's prices to PMSE users that could arise as a result of the licence fees paid by the band manager would cause significant disruption to PMSE users. This will assist us in determining the speed at which the band manager's licence-fee levels will increase until they reflect full opportunity costs.
- 8.32 We recognised in the DDR statement that we need to assist PMSE users' transition to a market-based approach to spectrum access. We also indicated that the setting of the band manager's licence fee – in terms of both initial level and subsequent increases – was one of these transitional measures that we could take for this purpose.

Structuring the band manager's licence fee

- 8.33 We propose to set the band manager a separate fee for each Ofcom-managed band awarded to it. This is because spectrum pricing should signal the relative values of these bands and encourage licensees to adjust their demand for spectrum on the basis of the value it generates for them and relative prices across bands. For each band, we would set an annual fee that would apply until it was subject to review. Section 9 addresses the frequency of such reviews.
- 8.34 We also propose initially to set fees for access to MOD-managed bands using the above approach. These fees would be charged to the band manager, not to the MOD. After the MOD puts in place new arrangements for the management of its spectrum, the terms of access (including price) will be subject to those arrangements, and any payment by the band manager at that time will not constitute a licence fee payable to us.

Question 27. Do you agree with our proposal to set a separate fee for each Ofcom-managed band to be awarded?

Question 28. Do you agree with our proposal initially to set fees for access to MOD-managed spectrum on a comparable basis?

Determining the band manager's licence fee

- 8.35 We propose to determine the band manager's licence fee by following the two-step procedure indicated above. First, we will derive estimates for the opportunity costs of the bands to be awarded. Second, we will set the band manager band-by-band licence fees that strike an appropriate balance between our objectives for this award, particularly in light of an assessment of their potential impact on PMSE users.

Opportunity costs

- 8.36 Because of the number of bands that we propose to award, estimating the opportunity costs of all of them is a time-consuming and resource-intensive process. Further, in the

period before the DDR awards, some of the relevant market data required for the estimates are particularly uncertain as some of the relevant and substitute spectrum will not yet have been valued in the market.

- 8.37 Notwithstanding these practical difficulties, it is important that we start signalling the value of the band manager's licence fee to PMSE users, who are keen to have an early indication. Set out below are our first indicative opportunity-cost estimates for key bands for which we believe or anticipate demand from all interested parties would outstrip supply at prevailing licence-fee levels. Annex 6 describes in more detail the steps we have followed to derive these estimates.
- 8.38 The estimates provided in this document are illustrative only. We will undertake further work to make appropriate opportunity-cost estimates of all of the bands to be awarded to the band manager. We expect that these estimates will differ from those presented in this document, but we believe that the information provided here gives a useful indication of the potential magnitude of the opportunity-cost estimates and resulting licence fees.
- 8.39 For the bands for which we anticipate current or future demand from all interested parties, including PMSE users, to be low or easy to meet at existing licence-fee levels, we would expect the opportunity cost to be at or near zero. These bands will often be those where existing PMSE demand and demand for potential alternative uses are low. In these bands, we would expect to set the licence fee to recover administrative costs. Annex 6 provides an indicative list of the bands that we consider may fall into this category based on spectrum-assignment data from JFMG but without considering possible alternative demand at this stage.
- 8.40 For those bands where we expect there to be significant excess demand at existing licence-fee levels, the initial indicative opportunity-cost estimates that we have derived (and as described in detail in annex 6) can be summarised as follows:
- **interleaved spectrum.** Low-power business mobile radio is a potential alternative use of interleaved spectrum. In our statement on modifications to spectrum pricing, published on 10 January 2007,⁴³ we compared current PMSE fees and an AIP fee based on business mobile radio use, although neither sought to fully reflect underlying opportunity costs. This comparison suggested that PMSE fees were three to four times lower than the level of AIP fees at that time.⁴⁴ Hence, we have used this benchmark to provide an indication of a possible lower bound for opportunity costs in this spectrum for the purposes of setting AIP for interleaved spectrum. The current fees for this spectrum paid to JFMG by licensees are in the region of £300k per year, which would suggest that a fee based on opportunity cost may be at least £900k per year. Another potential alternative use is DTT, more information on the value of which might be revealed as a result of the geographic interleaved awards. This may or may not imply a higher opportunity cost than that based on business mobile radio;
 - **channel 69.** We have identified a lower bound for the opportunity cost of this spectrum by considering its use as a single isolated channel. On this basis, it could be attractive to cellular mobile operators. The existing cellular spectrum tariff unit (STU) at 900 MHz provides an indicator of the value of this type of GSM use at this frequency, although the value of liberalised use for public mobile communications

⁴³ www.ofcom.org.uk/consult/condocs/pricing06/statement/statement.pdf.

⁴⁴ Paragraph 5.5 indicates that a UK-wide licence for private mobile radio in UHF spectrum cost in the region of £9,900 but an equivalent PMSE licence would cost around £2,700 per year.

may be significantly higher depending on the basis on which the channel was brought into such use. A more realistic estimate of the opportunity cost would take into account how this channel could in future be combined with the adjacent cleared spectrum, for which, as noted in section 3, CEPT is examining common technical conditions and international coordination and channelling arrangements. We expect that this would lead to a significantly higher opportunity-cost estimate. However, using the existing 900 MHz STU implies a lower bound for an indicative opportunity cost for the purpose of setting AIP of around £350k per MHz per year – i.e. £2.8m per year for the whole national 8 MHz channel;

- **talkback channels in UHF bands I and II.** As with interleaved spectrum, we have derived indicative estimates of the opportunity cost of these bands based on the assumption that the most likely alternative use of the spectrum is business mobile radio. Using the same approach set out above for interleaved spectrum suggests that a fee based on a lower bound of this opportunity cost could be around three to four times the current fee level.
 - In band I (420-450 MHz), the current fees paid to JFMG by licensees are in the region of £95k per year. This suggests that a fee based on the lower-bound opportunity cost could be around £280k per year for the 1.84 MHz of spectrum allocated to PMSE.
 - For band II (450-470 MHz), the current fees paid to JFMG by licensees are in the region of £250k per year.. This suggests that a fee based on the lower-bound opportunity cost could be around £750k per year; and
- **2 GHz.** We have not identified a significant likelihood of alternative use of this spectrum given its secondary-use status and the technical constraints that must be imposed on that use. However, there is currently congestion in existing PMSE use of about 70% of the band, implying that opportunity costs are higher than the administrative licence fees currently paid. We have derived an initial indicative estimate of this opportunity cost by considering the costs that would be incurred if PMSE users suffering from congestion in the band used alternative spectrum. This estimate is based on a weighted average of the cost to PMSE users of either using spectrum at 7 GHz or relying on satellite connection. We think that the costs of moving to 7 GHz are around £725 per MHz per year while the costs of relying on a satellite connection could be around £3,450 per MHz per year. Given the higher cost of a satellite connection, we have assumed that this will either not be used or will only be used in a small minority of cases (amounting to only 1% of the occasions on which spectrum access is required). On this basis, the indicative lower-bound opportunity cost is in the region of £725 per MHz per year – i.e. in the region of £150k per year in total for the 210 MHz of spectrum identified as being congested.

Initial and subsequent level of AIP-based fees

- 8.41 For each band for which we calculate an estimate of opportunity cost, we will also need to decide on the correct level of licence fee to charge.
- 8.42 When setting AIP-based licence fees where a full opportunity-cost-based fee would represent a significant increase on existing fees, we propose to set the initial level of the AIP element as a proportion of the full opportunity-cost estimate and then increase this percentage over time until the AIP element reflects our prevailing estimate of the full opportunity cost of the spectrum. The initial and subsequent proportions will depend

on our assessment of the impact of fees on PMSE users in the context of achieving a balance between our objectives for this award.

- 8.43 Opportunity costs change over time. Accordingly, we need to review both our general AIP policy and individual licence fees periodically to ensure they remain consistent with the bases on which they have been set. However, significant changes to licence fees can cause undue disruption to different types of user, so we seek to phase in such changes appropriately and, where necessary, over a number of years.
- 8.44 Moreover, we will only introduce AIP when the band manager begins operating. Our current timetable suggests that this could be 18 months away. In the intervening period, PMSE users will continue to have access to the spectrum to be awarded with AIP effectively set at zero.
- 8.45 We have identified three broad options for the duration of the phase-in of AIP to such a conservative estimate of opportunity cost. Table 3 summarises the pros and cons of each.

Table 3. Options for phasing in AIP to full opportunity cost

	Pros	Cons
No/minimal phase-in	<p>Early incentive to improve inefficient use of spectrum</p> <p>PMSE on level playing field with alternative users, obviating need for band manager to administer cross-subsidy</p>	<p>Very substantial increase in key bands, where early substitution/re-equipment is difficult. Adverse business impacts could be expected</p> <p>Where financial shocks are possible, early imposition of full AIP fees may be disproportionate</p>
Phase in over three years	<p>Easier transition for many PMSE users</p> <p>Clarity of price levels in the short to medium term</p> <p>Has been sufficient in other sectors to enable transition</p>	<p>Challenging transition for long-term assignment holders in terms of financial impact</p> <p>Some uncertainty for band manager, with changing demand profile to deal with after 2010</p>
Phase in over more than three years	<p>Easier transition for all PMSE users</p> <p>Longer time for band manager to consider and take any steps to enable more efficient use</p>	<p>Less efficient use of spectrum</p> <p>Longer-term phasing prolongs transition possibly longer than necessary in some bands</p>

- 8.46 At this stage, our view is that, for most bands, a three-year phase-in period is likely to offer a reasonable balance between allowing PMSE users to adjust to changes in fees and encouraging efficient spectrum use by reflecting its value in those fees. We propose to take this period as the starting point in considering how to deal with significant changes to the proposed level of the band manager's licence fee. However, we will take a different approach to particular bands where the circumstances warrant it. For example, if the AIP is very high compared to existing prices, we will consider a longer phase-in period. Conversely, the period may be shorter if the level of the AIP fee is very low compared to existing prices.

- 8.47 The impact of the fees set at full opportunity cost will depend on the characteristics of each band, including its opportunity cost, the number of assignments, the duration of these assignments, the intensity of use of the band and whether there is any suitable alternative spectrum available. We will seek to take all of these factors into account when setting fees. This is an additional reason for us to set fees (initially and subsequently over the chosen duration) on a band-by-band basis.
- 8.48 It is important to note that the band manager will have some degree of discretion in setting prices for different types of PMSE use, subject to the obligation that access be supplied to PMSE users on FRND terms. For example, at present, fees for short-term licences for any given frequency are high relative to the fees for annual licences. It is possible that the balance between these two types of product will change under the new regime, with short-term licences becoming cheaper and long-term licences becoming more expensive relative to each other. This will be particularly significant for those PMSE users, particularly of a community rather than professional nature, who do not require constant spectrum access throughout the year. New equipment that uses spectrum more efficiently will also reduce the impact of increased prices for PMSE users.

Indicative illustrations of applying AIP

- 8.49 At this stage, we are not in a position to propose the AIP-based fee because we only have a few indicative opportunity-cost estimates for some key bands. However, we believe that it is important for stakeholders to understand the considerations involved in introducing AIP and to have an illustrative indication of the order of magnitude of the fees that might result.
- 8.50 We set out those illustrative fee indications below for the bands for which we have derived initial indicative opportunity-cost estimates. We use the same approach for each band. First, we try to assess the impact of a licence fee reflecting the lower bound of opportunity cost. We do this by uniformly spreading the opportunity cost estimate across all assignment days (a measure of the intensity of use in a band). Second, we illustrate the fees that would result on an assignment-day and annual basis if the band manager spread the relevant licence-fee costs uniformly across charges to PMSE users.
- 8.51 These illustrative AIP fee indications are based on assumptions including the intensity of use in the band. The band manager may choose to adopt a different approach to setting the prices that it charges to users. Also, in addition to reflecting the cost of the AIP-based fees, the prices set by the band manager will need to recover its own administrative costs and allow it to earn an appropriate return on any investment made.
- 8.52 We use data – in particular the number of assignment days in various bands – recorded by Quotient Associates in its December 2006 report on supply and demand of spectrum for PMSE in the UK.⁴⁵ These data do not distinguish on the basis of bandwidth, duration or whether assignments are indoor or outdoor, and they do not reflect users' relative willingness to pay for the band manager's common costs. Applying a uniform cost-spreading rule may therefore be imprecise and have an impact on comparisons of the AIP element with existing fees.

⁴⁵ www.ofcom.org.uk/consult/condocs/ddr/reports/quotient_associates.pdf.

- **Interleaved spectrum**

- 8.53 We estimate the lower bound of the indicative opportunity cost at £900k. There were some 1,573,000 assignment days in interleaved spectrum in 2004/05. Taking the conservative approach of using the lower end of the opportunity-cost range, a uniform fee that fully reflected this would amount to about 57p per assignment day. This is much less than the existing wireless-microphone fee of £4.25 per day for a 48-hour period but more than the existing fee of 8p per day for an annual fixed-site indoor licence. The exact impact on users would therefore depend on both the band manager's decisions on pricing structure and licence constraints on its pricing flexibility
- 8.54 If we phased in AIP uniformly over a three-year period from the day the band manager started operating, it would amount to about 19p per assignment day in the first year, 38p per assignment day in the second year and 57p per assignment day in the third year. For those holding an annual wireless-microphone licence, setting fees at these levels would translate into an increase of about £70 in the first year, £139 in the second year and £209 in the third year compared to the current fees.
- 8.55 While the price rises indicated above would clearly have some impact on PMSE users, we consider that they would be able to adjust to them over a reasonable period of time by either absorbing them into their costs, using spectrum more efficiently or passing some or all of the increase along the supply chain. Assuming the band manager starts operating in 18 months' time and AIP is then phased in over three years, users would only face the new fees in full from 2013.
- 8.56 We will consider further the period that is appropriate for phasing in AIP on this band. It is arguable that it should be longer than three years.

- **Channel 69**

- 8.57 We estimate the lower bound of the indicative opportunity cost at £2.8m. There were some 608,000 assignment days in channel 69 in 2004/05. A uniform fee that fully reflected this opportunity cost would amount to about £4.61 per assignment day. This is comparable to the existing wireless-microphone fee of £4.25 per day for a 48-hour period but significantly higher than the existing fee of 8p per day for a fixed-site indoor licence.
- 8.58 If these fees were phased in over a period as short as three years, the price payable for some types of use of channel 69 would rise very rapidly indeed. Assuming, for illustration, that we phased in AIP uniformly over a three-year period from the day the band manager started operating, it would amount to about £1.54 per assignment day in the first year, £3.07 per assignment day in the second year and £4.61 per assignment day in the third year. For those holding an annual wireless-microphone licence, setting fees at these levels would translate into an increase of £560 in the first year, £1,121 in the second year and £1,681 in the third year compared to the current fees.
- 8.59 We do not regard increases at this rate as acceptable or consistent with our objective of facilitating PMSE users' participation in a market-based approach to spectrum.
- 8.60 It is, however, worth noting that, as indicated above, there are good grounds for supposing that the opportunity-cost estimate used here is significantly below the true alternative-use value of channel 69. The illustrative AIP figures for this spectrum should therefore be viewed as lower-end estimates.

8.61 We consider that a longer period than three years will be needed to phase in AIP for channel 69. However, it must be recognised that, under any plausible scenario, users will face a significant increase over present fee levels (£28 for an annual licence).

- **Talkback channels in UHF bands I and II**

8.62 The indicative lower-bound opportunity-cost estimate is £280k per year in UHF band I and £750k per year in UHF band II. Based on Quotient Associates' report, there were some 108,000 assignment days in UHF band I and some 476,000 assignment days in UHF band II, covering both wireless microphones and talkback, in 2004/05. We would expect the band manager to recover its AIP costs from all users based on their assignment characteristics.

8.63 A conservative estimate, using the lower end of the opportunity-cost range, for UHF band I amounts to some £2.59 per assignment day. For UHF band II, such a conservative approach gives a figure of some £1.58 per assignment day. In comparison, a typical talkback fee at present is £4.25 per assignment day for a 48-hour licence and 8p per assignment day for an annual licence.

8.64 In UHF band I, if we phased in AIP uniformly over a three-year period from the day the band manager started operating, it would amount to about 86p per assignment day in the first year, £1.73 per assignment day in the second year and £2.59p per assignment day in the third year. For those holding an annual talkback licence, setting fees at these levels would translate into an increase of £315 in the first year, £631 in the second year and £946 in the third year compared to the current fees.

8.65 In UHF band II, if we phased in AIP uniformly over a three-year period from the day the band manager started operating, it would amount to about 53p per assignment day in the first year, £1.05 per assignment day in the second year and £1.58 per assignment day in the third year. For those holding an annual talkback licence, setting fees at these levels would translate into an increase of £192 in the first year, £383 in the second year and £575 in the third year compared to the current fees.

8.66 If these figures are near to the opportunity costs that we calculate after further analysis, they would represent a very significant increase in the fees faced by PMSE users.

8.67 As with channel 69, we would therefore be minded to apply a longer phase-in period than the three years of our general policy to help users adjust to the new level of fees. In this case, our approach would also be guided by a lack of identified alternative spectrum. We would have to analyse the impact of these licence fees thoroughly in the context of PMSE users' ability to migrate to other spectrum and make our proposals for phasing in AIP accordingly.

- **2 GHz**

8.68 The indicative opportunity-cost estimate is in the region of £150k per year. There were some 31,000 assignment days in the 2 GHz band in 2004/05. Taking a conservative approach of using the lower end of the opportunity-cost range, a uniform AIP-based fee that fully reflected this would amount to about £4.84 per assignment day. This is significantly lower than the existing wireless-camera fee of £28 a day and any discounted fees obtained through carnet purchase (i.e. buying 60 or 480 assignments in advance).

8.69 If we phased in AIP uniformly over a three-year period from the day the band manager started operating, it would amount to about £1.61 per assignment day in the first year,

£3.23 per assignment day in the second year and £4.84 per assignment day in the third year. For those holding an annual wireless-camera licence, setting fees at these levels would translate into an increase of £589 in the first year, £1,177 in the second year and £1,766 in the third year compared to current fees..

- 8.70 The increase in fees for wireless-camera users in these frequencies would be relatively modest on the assumptions made above. We do not consider that there would be a case for applying a phasing-in period of longer than three years, which is normally sufficient for users in most sectors to adjust to fee changes of this proportion. Indeed, if our more detailed analysis indicates that these figures are broadly accurate, there may be a case for applying a phasing-in period of less than three years.

Summary

- 8.71 The above illustrations show clearly how much the characteristics of each band matter in determining the band manager's initial and subsequent AIP-based fees because the opportunity cost, the implied change in spectrum costs and users' ability to respond in the short and medium term varies between bands.
- 8.72 So far, using relatively low estimates of opportunity costs, we believe that the impact of introducing AIP over a three-year period appears to be manageable in relation to 2 GHz and possibly interleaved spectrum (though further consideration is needed).
- 8.73 We think that a longer period will be needed for channel 69 and talkback channels in UHF bands I and II.
- 8.74 We are aware that the illustrations given in this document depend critically on the assumptions we have made. It is also worth noting that the band manager may choose to adopt a different approach to setting charges to customers. As indicated above, the requirement to price on an FRND basis will still allow some latitude to design different tariff structures (e.g. with differentiation by time or geography). Different tariff structures are likely to be more or less effective at encouraging more efficient use of spectrum.
- 8.75 We expect to publish a second consultation document before the end of the year that addresses the issue of AIP, among others, in more detail. This document will propose AIP figures for all bands to be awarded to the band manager and make proposals for the phasing-in periods to be applied.
- 8.76 In the meantime, we welcome comments on our proposed approach to setting the band manager's licence fee.

Question 29. Do you agree with our proposal to determine the band manager's licence fee first by deriving estimates of the opportunity costs of the spectrum to be awarded and second by setting band-by-band prices that strike an appropriate balance between our objectives for this award?

Question 30. What are your views on the options for phasing in AIP to full opportunity cost?

Reviewing the band manager's licence fee

- 8.77 As explained above, we intend to set the band manager's initial licence fee by:
- estimating ranges for the opportunity cost of each band and being conservative in choosing a value from the lower ends of these ranges; and

- determining the proportions of opportunity costs to be reflected in the licence fee in each of the next three years, taking into account our objectives for this award.
- 8.78 We propose to set the licence fee initially for a period of three years and to conduct a detailed review of the opportunity-cost estimates and associated licence-fee levels for all of the spectrum to be awarded after those three years. This review will take into account:
- our general spectrum-pricing framework at the time;
 - specific market information on spectrum values that will become available following the digital dividend and other relevant awards; and
 - broader market experience in the relevant bands and in the PMSE sector.
- 8.79 Thereafter, we propose to review the licence fee periodically but no more frequently than every three years. This would provide a degree of stability and regulatory certainty for the band manager and its customers and so reduce transactions costs.
- 8.80 These reviews, taking into account market value information, would be an important aspect of our assessment of spectrum efficiency going forward. They could lead to increases or reductions in licence-fee levels depending on how technology and market changes affected opportunity costs. However, overly frequent reviews would reduce the band manager's incentives to generate value through better spectrum management. We are therefore minded to consider adjusting the AIP-based fee to reflect increases in spectrum value with a lag.
- 8.81 Any proposals to alter licence-fee levels will be subject to consultation.

Question 31. Do you agree with our proposal to set the band manager's licence fee for three years and to review it after that period?

Question 32. Do you agree with our proposal to review the band manager's licence fee periodically but no more frequently than every three years thereafter?

DTT multiplex issues

- 8.82 The DDR consultation document noted that the Communications Act gave us the power to operate a simpler and more flexible regime that would allow spectrum to be used to carry broadcast services such as those already available on the DTT platform.
- 8.83 Under this regime, it is only necessary to hold a licence under the Wireless Telegraphy Act in order to operate a multiplex that may carry broadcast services. It is not, therefore, necessary also to hold a multiplex licence issued under the Broadcasting Act.
- 8.84 The DDR statement confirmed that we expected to use this new regime in relation to the digital dividend, removing the requirement for a person to hold a multiplex licence under the Broadcasting Act. Content providers would, however, still need to hold the appropriate Broadcasting Act content licence.
- 8.85 The DDR statement also noted that we had considered whether it would be desirable to retain some limited elements of the Broadcasting Act regime and that we would set out proposals regarding the inclusion of certain ownership restrictions to disqualify certain groups from operating a television or radio multiplex and to address

interoperability between the existing DTT platform and any new television multiplexes using the digital dividend. These issues are relevant to this award because of the possibility of using the interleaved spectrum included in the band manager's licence for the provision of a (particularly local) DTT multiplex service.

- 8.86 The proposals below apply equally to the cleared and geographic interleaved awards, and the consultation documents that we have published on these two awards set out the relevant proposals.
- 8.87 We have also considered whether there are other aspects of the obligations contained in Broadcasting Act multiplex licences that should be retained under the approach that we propose to adopt, of awarding licences under the Wireless Telegraphy Act only. In particular, Broadcasting Act licences typically contain conditions relating to competition.
- 8.88 However, we consider that the proper context in which to consider potential conditions relating to competition issues is in relation to a discussion of the effects of the award on competition more generally and the potential effects on relevant markets. This is addressed in section 9.

Ownership

- 8.89 We think that there are important reasons for considering whether to impose any restrictions on the identity of users of the interleaved spectrum awarded to the band manager for the purpose of operating a multiplex carrying broadcast services.
- 8.90 The fundamental point is that, whatever the technical and operational distinctions between existing DTT multiplexes (operated under both a Broadcasting Act licence and a Wireless Telegraphy Act licence) and new DTT multiplexes (which may be operated under a Wireless Telegraphy Act licence only), the services that they provide may be indistinguishable in the eyes of viewers.
- 8.91 As noted above, content providers are required to hold the appropriate content licence issued under the Broadcasting Act. This requirement applies to content providers across all broadcasting platforms. At the platform level, however, Parliament has deliberately chosen to distinguish between the provision of those services via a multiplex – disqualifying certain categories of person from holding a Broadcasting Act multiplex licence – and via other networks (e.g. satellite and cable).
- 8.92 We consider that these rules were aimed primarily at minimising the potential for information or opinion to be distorted or manipulated. We also consider that, in relation to DTT multiplexes, these rules reflect viewers' familiarity with terrestrial television and its importance as the mechanism for ensuring near-universal availability of public-service content.
- 8.93 Categories of persons disqualified from holding broadcasting multiplex licences under the Broadcasting Act include the following:
- local authorities;
 - political bodies;
 - religious bodies;

- publicly-funded bodies;⁴⁶
- bodies exerting undue influence;
- broadcasting bodies, specifically the BBC and S4C; and
- advertising agencies.

8.94 The Communications Act nonetheless obliges us to consider the ownership rules in relation to broadcast media at least every three years. It does so in the recognition that communications markets are developing rapidly and are likely to continue to do so, which may in time mitigate the need for specific ownership restrictions and rules. Our first review in November 2006 concluded that there was no clear reason for such changes.⁴⁷

8.95 We have borne these conclusions in mind in considering which, if any, ownership restrictions to apply to the use of the interleaved spectrum awarded to the band manager to operate a DTT multiplex. At the same time, we have had regard to our duty to ensure our actions are targeted only at cases in which action is needed.

8.96 Where the interleaved spectrum awarded to the band manager is used to operate a multiplex for carrying DTT services, we propose to:

- include ownership restrictions that replicate those in the Broadcasting Act relating to –
 - local authorities;
 - political bodies;
 - religious bodies; and
 - bodies exerting undue influence; but
- not to replicate the restrictions related to –
 - broadcasting bodies. This no longer appears appropriate given that BBC Free to View Ltd. already holds a Broadcasting Act multiplex licence (for Multiplex B) and is directly under the control of the BBC; and
 - advertising agencies. We do not believe it would be objectively justified to restrict persons in this class from holding a Wireless Telegraphy Act licence for this purpose as we do not see evidence that this would be likely to distort the market for advertising and all content restrictions in relation to advertising will apply in any event via the regulation of content provision.

Question 33. Do you agree that where the interleaved spectrum to be awarded to the band manager is used for the operation of a DTT multiplex, we should replicate the ownership restrictions in the Broadcasting Act regime relating to (a) local authorities, (b) political bodies, (c) religious bodies and (d) bodies exerting undue influence but not replicate restrictions relating to (e) broadcasting bodies and (f) advertising agencies?

⁴⁶ Radio-service licences only.

⁴⁷ www.ofcom.org.uk/research/media_owners/rulesreview/rules.pdf.

- 8.97 In proposing that we replicate the ownership restriction related to local authorities, we have been mindful of our position, set out in the DDR statement, that explicit support through direct funding for services that can provide broader social value is more transparent and can achieve a better outcome than reserving spectrum for those services. We therefore wanted to ensure that this ownership restriction would not work against any services (e.g. local television) that might require funding from such sources to be viable.
- 8.98 We believe that it is entirely feasible to separate funding of the acquisition of spectrum from the ownership of a DTT multiplex. The ownership restriction related to local authorities should not prevent potential funding from such bodies for those wishing to provide local television services provided the funding does not give rise to “*de facto*” control of a multiplex or “undue influence” adverse to the public interest.
- *De facto* control – this will arise if the funding arrangements put the provider of those funds in the same position as a controlling shareholder. This is more than mere influence, allowing the local authority to fulfil its wishes over and above other shareholders.
 - Undue influence adverse to the public interest – there must be no influence exerted on the multiplex owner that might serve political or other ends. Limited financial assistance, in the form of a loan or grant, may be acceptable provided it does not result in the exertion of influence that is adverse to the public interest. Each grant or loan would need to be considered on a case-by-case basis.
- 8.99 We encourage parties requiring direct funding to access this spectrum via the band manager to think about how they can secure funds from a variety of sources (including but not limited to local authorities) and to ensure that they comply with all the rules relating to funding.
- 8.100 In considering how best to implement in Wireless Telegraphy Act licences ownership restrictions that are equivalent to those currently included in Broadcasting Act multiplex licences, we will also need to consider whether any related conditions are required to enable us to monitor and audit compliance with the ownership restrictions imposed (e.g. requiring the user to inform us of any change in ownership and to provide us with relevant information at our request regarding ownership, control and undue influence).

Interoperability

- 8.101 Viewers benefit from and greatly value being presented with a common service across all six existing DTT multiplexes. This outcome is achieved by the current framework under which the six multiplexes interoperate. This is necessary because the multiplexes are independent of each other, unlike vertically integrated platforms such as satellite or cable, and so some cooperation between the multiplex owners is required to ensure that viewers on any particular multiplex are presented with a common set of services rather than the service offerings of that particular multiplex.
- 8.102 When the first DTT multiplex licences were awarded in 1998, the Independent Television Commission required compliance with its Technical Code and associated Community Digital Standards. These documents now exist as our Television Technical Performance Code⁴⁸ and Reference Parameters for Digital Terrestrial Transmissions in the United Kingdom,⁴⁹ which define the technical standards and operating parameters

⁴⁸ www.ofcom.org.uk/tv/ifi/tech/codes_guidance/tv_tech_platform_code.pdf.

⁴⁹ www.ofcom.org.uk/tv/ifi/tech/codes_guidance/dttt_uk2.pdf.

that the existing multiplex operators are required to adopt. The latter document details a subset of transmission standards agreed within the European Telecommunications Standards Institute to which operators should adhere:

- frequency parameters – what kinds of signal are used to carry a multiplex (e.g. DVB-T, 64QAM);
- encoding standards – how the programmes carried in the multiplex are put into a form suitable for broadcasting (e.g. MPEG-2, MPEG-4);
- service information – the datastream normally invisible to viewers that is essential for receivers to operate. Some parts of the stream are used to populate the Freeview electronic programme guide, allowing viewers to obtain up-to-date information on all DTT services regardless of what they are watching;
- Application Programme Interface – the software that displays graphics and enables interactive services to function (e.g. MHEG-5); and
- access services (e.g. subtitling).

8.103 At the same time, there is focused voluntary cooperation on the part of the multiplex operators in addition to compliance with the two documents mentioned above. This takes place through the Digital Television Group,⁵⁰ which publishes, maintains and promotes adherence to the D-Book, setting out the detailed technical standards for DTT in the UK, and runs the sector's test and conformance centre. The operators also pay for and maintain equipment such as the Central Service Information Collator, which combines information on programmes on all the multiplexes to produce the service information broadcast on each.

8.104 Against this backdrop, and given the possibility that the interleaved spectrum awarded to the band manager could be used to deliver new DTT services, we have considered the issue of interoperability with the existing multiplexes and the extent to which regulatory intervention may be needed to secure this. We have identified three options:

- **do nothing.** Under this option, interoperability would only arise through the voluntary agreement of existing and new multiplex operators. It could be achieved by new operators adopting the same technical standards and operating parameters as existing operators and existing operators adapting their systems as necessary to accommodate new operators. Given that, under this option, interoperability will only arise if the new and existing multiplex operators can reach agreement, there is some risk that it will not be secured in the future. Given that viewers have benefited from the existence of interoperability arrangements to date, our view is that it is likely to be unattractive to take this risk;
- **facilitate.** Under this option, we would require existing multiplex operators to interoperate with new operators at the request of the latter. We would propose to vary existing operators' Broadcasting Act licences if necessary to achieve this. If new operators wished to take advantage of this opportunity, they would need to operate within the same technical code and operating parameters as existing operators. They would not, therefore, be free to adopt some aspects of the technical code and operating parameters while rejecting others. (However, the technical code and operating parameters themselves include a number of choices open to multiplex operators.) This option preserves some flexibility for new

⁵⁰ www.dtg.org.uk.

operators since it is not overly prescriptive about whether and when interoperability is achieved, but it would set out a clear expectation that it will occur subject to the choice of new operators. It also would enable us to intervene if circumstances frustrated such agreements being reached. It does not, however, guarantee viewers the benefits of interoperability across all multiplexes, nor that this will happen at the earliest possible time. We stress that we would expect new operators gaining interoperability in this way to play a full role in the maintenance and promotion of the DTT platform rather than adopt a pick-and-mix approach to its individual components; and

- **mandate.** Under this option, we would require existing and new operators to interoperate in full as specified by us both in terms technical standards and the time at which it should be achieved. Again, new operators would need to adopt the same technical standards and operating parameters as existing operators, while we would vary existing operators' Broadcasting Act licences as necessary. This would guarantee viewers the benefits of interoperability across all multiplexes but at the expense of automatically precluding alternative market offerings that could deliver different, possibly greater benefits. As yet, we are not aware of a compelling reason to intervene to this extent.

8.105 On balance, our initial view is that interoperability is likely in the future to bring benefits to viewers as it has in the past. Therefore, if the interleaved spectrum awarded to the band manager is to be used for new multiplexes, we consider it appropriate to take some steps to encourage the emergence of interoperability so that those benefits are realised in relation to such new multiplexes. However, our preference is for the industry to secure this itself within a framework set by us rather than for us to mandate interoperability. Accordingly, we propose to facilitate interoperability between existing and new multiplex operators at the request of the latter.

Question 34. Do you agree that we should facilitate interoperability between existing DTT multiplex operators and new operators using the interleaved spectrum awarded to the band manager?

Provision of information to facilitate optimal spectrum use

8.106 In line with our duty to manage the spectrum efficiently, we propose to include a condition in the licence to be awarded – standard across all the licences awarded for use of the digital dividend – to require the band manager to provide us on request with general information regarding the use of its spectrum. From time to time, we may publish aggregated information received on spectrum use in areas across the UK in order to help secure its optimal use by helping interested parties who do not have access to identify where they may provide additional services by transacting with licensees in those bands.

8.107 We consider that this approach is objectively justified to fulfil our statutory duties and objectives, is transparent and proportionate and does not discriminate between licensees.

8.108 We are currently investigating the type and scope of information that it would be useful to provide for this purpose. Therefore, we are particularly interested in stakeholders' views on information they think would help to facilitate efficient use of spectrum and secondary trading and on the impact disclosing this information might have on licensees. In this respect, there are a number of relevant considerations to bear in mind:

- the extent to which information provided might fall under the scope of the Environmental Information Regulations 2004 (SI 2004/3391);⁵¹
- the ways in which spectrum use and assignments can be compared in order to identify unused spectrum in a way meaningful to external stakeholders, particularly in comparing use of cleared and interleaved spectrum;
- the wide variety of potential uses of the spectrum concerned, each of which might require different types of transmission network and use different business models to define affected customer bases (e.g. free-to-view broadcast transmissions versus subscriber-based business models);
- the restrictions that might need to be placed on publishing information to preserve as far as possible appropriate commercial confidentiality and satisfactorily address security concerns;
- the balance that needs to be struck between information specific to the digital dividend and (potentially more limited) information comparable across a wider range of bands;
- the benefits of providing users with as much useful information as possible versus the costs and risks of users providing data; and
- the benefits and costs of our aggregating and presenting data in particular formats (e.g. to enable ready geographic comparison of use and assignment data in particular bands).

8.109 We are currently considering the issue of spectrum information more widely and plan to publish consultation proposals later this year. We will take account of responses to this consultation in developing our more general proposals.

Question 35. What are the merits of our proposed approach to providing spectrum information, in particular concerning the type of information that might be helpful and any impact that publishing information might have both on licensees and the wider spectrum market?

Change of ownership

8.110 A change of ownership of the band manager will not affect its obligations under its licence.

Summary

8.111 The key technical licence conditions that we are proposing to include in the band manager's licence relate to a BEM approach based broadly on existing arrangements for PMSE spectrum access.

8.112 The key non-technical licence conditions that we are proposing to include in the band manager's licence relate to:

- an AIP-based licence fee set at a level that reflects the economic value of each band but is set conservatively and phased in to avoid significant disruption to PMSE users;

⁵¹ www.opsi.gov.uk/si/si2004/uksi_20043391_en.pdf.

- ownership restrictions where the interleaved spectrum awarded to the band manager is used for the operation of a DTT multiplex;
- facilitating interoperability between existing DTT multiplex operators and new operators using the interleaved spectrum awarded to the band manager;
- the provision of information to promote efficient use of spectrum;
- licence duration (see section 6);
- commitments made by the successful applicant (see section 7); and
- PMSE protection (see section 9).

Section 9

PMSE protection

Introduction

- 9.1 The DDR statement outlined that we saw barriers to the formation of a market for PMSE access to spectrum. Among our proposals to ensure that PMSE users would continue to have access to spectrum during the transition to a market-based approach was the establishment of a single band manager for the interleaved spectrum and channel 69. We were mindful of the risks inherent in creating a dominant supplier of spectrum for some users – now underscored by our proposals in this consultation document to award most of the spectrum outside the digital dividend currently allocated to PMSE to the same band manager – and stated our intention to ensure that PMSE users would receive transitional protection to ensure that they would not suffer significant disruption.
- 9.2 As set out in section 3, our duties require us to secure the optimal use of spectrum and to take account of the desirability of promoting competition. In this section, we explain how our proposals strike an appropriate balance between these considerations.
- 9.3 This section also sets out our assessment of whether we have taken the appropriate opportunities to promote competition and efficiency through the award of this spectrum as well as detailed proposals for protecting PMSE users during the transition to a market-based approach to spectrum access. In particular, we describe what we mean by the band manager’s obligation to meet “reasonable” PMSE demand, its role in making spectrum available for future major events and how we envisage disputes between the band manager and its customers being settled.

Promoting competition and efficiency

- 9.4 When awarding spectrum, we consider how we can best promote competition and efficiency. Competition generally brings significant benefits to citizens and consumers. In the context of this award, we would expect it to benefit PMSE users as well (e.g. by providing suppliers of spectrum with incentives to reduce prices and increase their quality of service). Efficiency, in relation to either spectrum use or service provision more generally, is also important if we are to maximise the total value to society generated by using the spectrum to be awarded. Spectrum is a valuable and scarce resource, and failing to get the most out of it could potentially result in a significant loss for citizens and consumers – and again, in this case, for PMSE users.
- 9.5 In our consultation documents on the cleared and geographic interleaved awards, we assess how these awards can best promote competition and efficiency in downstream markets. This involves a three-step process of considering:
- how award design and packaging can promote competition and efficiency;
 - whether there is a need for us to put in place general safeguards (e.g. a spectrum cap or requirements for information provision) to promote competition and efficiency; and
 - whether there are specific issues in relation to individual potential uses of the spectrum that could result in a significant risk of market failure, owing to a failure of

the award to fully promote competition and efficiency, and hence may warrant targeted intervention in the award.

- 9.6 We now consider how to apply each of these steps to the band manager award.
- 9.7 The award-design and packaging decisions in this award have involved a trade-off between promoting competition and efficiency. As mentioned above, competition generally brings benefits, but there are some circumstances in which promoting competition is not consistent with promoting efficiency. These are situations in which the benefits of additional competition are less than the costs. In the case of the band manager award, PMSE users have expressed a preference for a single band manager because of their experience of dealing with multiple spectrum providers in the past, and we believe that, at least in the short term, the opportunity for multiple competing suppliers of spectrum is limited by the inflexible spectrum requirements of PMSE users. Therefore, while in principle we could have sought to promote competition by awarding more than one package of spectrum, we are mindful of the preferences of PMSE users and our objective of avoiding significant disruption. We also note the limits on PMSE users' ability to substitute use of one band for another in the short term. Taken together, we think that this suggests there are limits to the competition benefits of multiple band managers in the short term and that competition could introduce costs that, even if not significant in their own right, need to be viewed within the perspective of the wider challenges that PMSE users face during the transition to a market-based approach. Hence, we think that awarding the spectrum to a single band manager strikes an appropriate balance between our duties to promote competition and efficiency. However, we note that there may be greater scope in the future for introducing competition in the provision of spectrum access to PMSE users.
- 9.8 In relation to whether there is a need for any general safeguards to promote competition and efficiency, the only one that we think is relevant concerns information provision. As explained in section 8, we think that such a safeguard may be justified in helping to reduce information asymmetries between spectrum users and facilitating an efficient spectrum market. Other general safeguards considered in the cleared and geographic interleaved consultation documents are use-it-or-lose-it requirements, rollout obligations, access requirements and spectrum caps. Given the nature of the band manager award, which involves a single package of spectrum that is generally already used and bears obligations to PMSE users, we do not think that any of these safeguards are relevant.
- 9.9 To identify whether there are specific risks of market failure, we need to consider the potential downstream uses of the spectrum to be awarded to the band manager. In relation to this award, the most likely use of the spectrum, at least in the short term, is for PMSE. Information on alternative uses is currently limited, and the likelihood of significant alternative use in the short term will be constrained by our protection of PMSE users during the transition period. Hence, our assessment of specific risks of market failure has focused on the issues that might arise in relation to PMSE use alone. If significant risks of market failure emerge in relation to other uses in the future, we retain the right to revoke the licence on spectrum-management grounds (subject to the appropriate notice period) and the ability to resolve significant competition issues that arise through our sectoral and competition powers.
- 9.10 With regard to PMSE use of the spectrum to be awarded to the band manager, our approach has already been driven by our desire to resolve a transitional market failure faced by users. This relates to the coordination difficulties these users currently face and the impact of these on their ability to participate in a spectrum market. Our proposals for this award are designed to resolve this market failure and are consistent

with our duty to secure the optimal use of spectrum. Without our intervention, PMSE users would be unable to reflect their value for spectrum in a market, and the resulting disruption to users could reduce the value generated for society from their use of the spectrum.

- 9.11 However, as discussed above, we think that it would not be possible to fully promote competition in the award as, in the short term at least, introducing multiple spectrum suppliers might involve costs (e.g. additional administrative costs for PMSE users) that were not outweighed by the competition benefits given the limited short-term opportunities for these users to substitute one spectrum band for another. Hence, our award might result in a competition market failure. This is because we are awarding all the spectrum that will be allocated to PMSE to a single band manager, who hence will be a dominant provider of spectrum to these users.
- 9.12 Reflecting on our objectives for future PMSE spectrum access and on the potential impact of a dominant provider during the transition period, we believe that we need to consider measures to protect PMSE users to ensure that their reasonable demand is met on FRND terms. The proposals set out in the remainder of this section are designed to achieve this.
- 9.13 We note that, in the longer term after the transition to a market-based approach to spectrum access, there may be greater opportunities for promoting competition in the provision of spectrum access to PMSE users. And if significant competition or efficiency concerns arise in the future, we retain the right to vary or revoke the band manager's licence on spectrum-management grounds (subject to the appropriate notice period) and the ability to resolve significant competition issues that arise through our sectoral and competition powers.

Question 36. Do you agree with our assessment of whether our approach to awarding this spectrum appropriately promotes competition and efficiency?

Ensuring PMSE access to spectrum is protected

- 9.14 We committed in the DDR statement to ensuring that the band manager met reasonable PMSE demand for spectrum on FRND terms to help us meet our objective of avoiding significant disruption to PMSE users.
- 9.15 We set out below our proposed interpretation of "reasonable" demand and outline our proposed approach to FRND terms.

"Reasonable" PMSE demand for the spectrum to be awarded

- 9.16 There are, in principle, three ways in which we could require the band manager to meet "reasonable" PMSE demand for the spectrum to be awarded:
- by reserving spectrum based on current PMSE demand, identified through spectrum-assignment data from JFMG;
 - by reserving spectrum based on a forecast of future PMSE demand; and
 - by satisfying actual future demand from PMSE users at FRND prices.
- 9.17 Table 4 sets out the pros and cons of these three options.

Table 4. Options for determining “reasonable” PMSE demand

	Pros	Cons
Reserving spectrum based on current demand	Little disruption to PMSE users	Inefficient use of spectrum Significant difficulties in accommodating future demand
Reserving spectrum based on a forecast of future demand	Little disruption to PMSE users if the forecast is right	Inefficient use of spectrum Significant risk that the forecast will be wrong
Satisfying actual future demand at FRND prices	Takes account of future changes in demand, including in response to spectrum pricing	Possibility of some short-term disruption depending on how we determine FRND pricing

- 9.18 The first option is a form of “ringfencing” of spectrum based on the amount currently being used. If we thought that demand for PMSE access to spectrum would be static over the coming years, there might be some merit in such an approach. However, we expect a more dynamic evolution in PMSE demand, not least because of the increased incentives to make more efficient use of spectrum in the longer term. These demand changes will inevitably render reservations based on historic patterns of use inefficient.
- 9.19 Ringfencing spectrum based on a prior estimate of future demand could avoid some of these problems. However, while it might be possible to forecast broadly how much spectrum PMSE users will want to access in aggregate in the future, it is much less clear where that demand will manifest itself within the bands available via this award and alternative sources. Reserving spectrum in this way may therefore result in protecting the wrong capacity for future requirements.
- 9.20 The third option does not have these problems in that reasonable demand is automatically defined as what PMSE users are prepared to pay for at FRND prices. In contrast to the first and second options, it allows for changes as PMSE users respond to pricing changes and technological developments. We therefore consider it to be the most workable definition of reasonable PMSE demand.

Question 37. Do you agree with our proposal that “reasonable” PMSE demand for the spectrum awarded to the band manager should be defined as the actual demand from PMSE users at FRND prices?

Fair, reasonable and non-discriminatory terms

- 9.21 The objective of requiring FRND terms for PMSE users’ access to the spectrum awarded is to avoid the opportunities for a single, dominant band manager to assign spectrum inefficiently and generate excess profits and instead to provide an appropriate incentive to encourage spectrum access to be supplied in conditions that more closely reflect those that would be expected in a competitive market. We recognise that there are difficulties in achieving this in practice. Regulatory action cannot fully substitute for the working of a competitive market.
- 9.22 An important aspect of FRND terms is pricing. When determining whether a price is FRND, we would need to have regard to certain costs incurred by the band manager. As a general principle, we would take into account costs that are reasonably,

necessarily and efficiently incurred to provide services. These costs must be reasonably linked to an input that is indispensable to the delivery of the band manager's commitments.

- 9.23 Prices should also allow for a reasonable return on the costs incurred that reflects the risk-adjusted cost of capital of the investment. It will also be important to ensure that there are incentives for efficiency, to ensure that costs are kept to the minimum necessary.
- 9.24 We will expect the prices the band manager charges to PMSE users to reflect the band manager's efficiently incurred costs (administrative costs and AIP) and also the levels of congestion in the spectrum concerned:
- where there is no scarcity of spectrum for PMSE use, prices should be set to recover the band manager's allowable costs (including a reasonable return on capital); but
 - where there is excess demand caused by competing PMSE use, prices should be increased from a pure cost-recovery level to help ration demand and hence to match demand with the supply of spectrum. This process should not discriminate unduly against certain users.
- 9.25 We will expect the band manager to adhere to non-discriminatory charging of PMSE users. The key elements of this principle are that:
- comparable prices should be offered to comparable users for comparable services at comparable times; and
 - differential prices may be offered where it is reasonable to do so.
- 9.26 We would expect to see some price differentiation between PMSE users based on service offering or market conditions. This could reflect variations in:
- bandwidth or power;
 - geographic area, particularly where there are differences in population coverage;
 - congestion between PMSE users; and
 - duration of assignment.
- 9.27 We will provide further guidance on how pricing should be assessed against the requirement to be FRND. We will also indicate what information the band manager should provide when its prices are to be assessed against the FRND requirement. In that guidance, we will provide applicants with detailed information about how we will ensure that any assessment of whether FRND pricing has been adhered to will take into account the various efficiency gains that the band manager could realise in the course of operating. It is not our intention to penalise the band manager for increasing its profits as a result of such efficiency gains.

Question 38. Do you agree with our proposals for ensuring that the band manager meets reasonable PMSE demand on FRND terms?

Duration of protection

- 9.28 In the DDR statement, we assessed the options open to us in setting the period during which PMSE users would be protected. In doing so, we balanced the lifecycle of equipment with the opportunity cost of precluding alternative uses of the spectrum. We were also mindful of giving users sufficient time to prepare for any changes that a band manager felt compelled to introduce.
- 9.29 We considered at that time that a protection period of 10 years, lasting until 2018, achieved this balance. We still consider this to be the case and will therefore apply the licence conditions protecting PMSE users to all the spectrum to be awarded until that date.

PMSE spectrum access for major events

London 2012 Olympic Games and Paralympic Games

- 9.30 As part of London's bid for the 2012 Games, the Government guaranteed to the International Olympic Committee the allocation of the frequencies required for the organisation of the Games. We published a discussion document on 30 November 2007 seeking views from stakeholders on spectrum requirements for the Games⁵² and a summary of responses on 7 May 2008.⁵³
- 9.31 In the DDR statement, we considered the role that the digital dividend could play in meeting the spectrum requirements of the London Games. We suggested there might be a case for retaining a power of direction over the band manager so that we could access the spectrum awarded to it and require its assistance with spectrum planning and licensing where necessary.
- 9.32 On reflection, we do not think it appropriate to compel the band manager to assist with spectrum planning and licensing, although we might wish to engage its services through subsequent commercial negotiation. But we consider it certain that we will need access to some of the spectrum to be awarded to meet the requirements of the London Games for audio links and video links. We propose to secure this by incorporating a suitable condition in the licence awarded to the successful applicant to make it clear that we might use our power under paragraph 8(5) of schedule 1 to the Wireless Telegraphy Act to vary the terms of the licence at any time if it appears to us to be necessary or expedient to do so for the purpose of securing compliance with any international agreement or arrangements relating to the London Games to which the UK is a party.
- 9.33 We expect to consult on a draft spectrum plan for the London Games after the Beijing 2008 Olympic Games and Paralympic Games.

Glasgow 2014 Commonwealth Games

- 9.34 As part of Glasgow's bid for the 2014 Commonwealth Games, the Government gave identical guarantees on spectrum allocation. We believe that the same considerations apply here as to the London Games.

Question 39. Do you agree with our proposal to incorporate a suitable licence condition to enable us to access the spectrum awarded to the band manager to meet the

⁵² www.ofcom.org.uk/consult/condocs/spectrum2012/condoc.pdf.

⁵³ www.ofcom.org.uk/consult/condocs/spectrum2012/statement/statement.pdf.

requirements of the London 2012 Olympic Games and Paralympic Games and the Glasgow 2014 Commonwealth Games?

Other major events

- 9.35 The Government has entered into international obligations in relation to the London and Glasgow Games. This means that we, and the Government, have wide-ranging powers to vary or revoke existing Wireless Telegraphy Act licences to ensure that the spectrum needs of these events are met.
- 9.36 There are, however, many other major events in relation to which no such international obligations exists but that nonetheless create additional demand for spectrum. It is very important to the cultural, economic and social life of the UK that these events continue to be held successfully, with the use of modern technologies to support broadcasting and event management.
- 9.37 The largest of these events typically require temporary use of spectrum over and above that allocated to PMSE and the subject of this award. We play a key role in securing access to these additional frequencies, using our understanding of spectrum use to identify additional frequencies that might be made available and then, if relevant, negotiating with the users of those frequencies to secure temporary access. A spectrum plan is then assembled that includes use of both the frequencies that are allocated to PMSE on a continuous basis and the frequencies used on a temporary basis.
- 9.38 Under existing legislation, this process necessarily involves negotiation and agreement with affected parties. The spectrum needs of major events have, however, been met successfully on all occasions. Major events in this context include the Tour de France's visit to southeast England in 2007, the British Grand Prix and other sporting events and large-scale concerts such as Live8.
- 9.39 It is, however, likely to become increasingly important to ensure that there is thorough planning and preparation for the spectrum needs of major events given the rising intensity of spectrum use in general. It is also likely that the cost of meeting the spectrum needs of these events will continue to rise. This is because the process of planning and coordination is likely to become more demanding over time and so more costly. On occasion, it may also be necessary to compensate existing users for any inconvenience caused by temporary use for PMSE.
- 9.40 The proposals in this document do not make a material change to the arrangements for meeting the spectrum needs of events such as these. The spectrum that is awarded to the band manager will remain available for PMSE (subject to the conditions of the licence) and must be the first port of call for meeting the spectrum needs of major events. If a particular event clearly requires access to additional spectrum beyond what the band manager can supply, we will be ready to work with users to identify how their spectrum needs might be met.
- 9.41 We may contract with the band manager to supply technical services that will help us in this task, we may contract with another party, or we may perform the work in house. This is similar to the arrangements that exist now with JFMG.
- 9.42 We will expect to recover our reasonable costs when we engage in an activity of this kind in future. We will also encourage the organisers of major events to consider how their spectrum requirements can be met through the use of market mechanisms (e.g.

by approaching users of spectrum directly to secure temporary access or using an agent to undertake this activity on their behalf).

- 9.43 We believe that effective planning and communication will be key to ensuring efficient arrangements for spectrum for major events in the future. Organisers must understand the significance of spectrum access to the successful running of their event and the importance of entering into early discussions with the band manager..

Question 40. Do you agree with our proposed approach to spectrum access for other major events?

Dispute resolution

Disputes with PMSE users as a whole

- 9.44 In keeping with the wishes of PMSE users, we are awarding spectrum to a single band manager who will have obligations toward them. By doing so, we are creating a dominant supplier of spectrum to PMSE users who cannot currently take part in a market-based approach to spectrum. A dominant supplier may have an incentive to price its services at a level above what would be expected in a competitive market. It may also have insufficient incentive to provide a high-quality service or to fulfil specific obligations to its customers. In the case of the band manager, such outcomes would be against our key objective of avoiding significant disruption to PMSE users.
- 9.45 While we will enshrine commitments about pricing and service levels made by the successful applicant in the licence to be awarded, we will also need an effective mechanism to ensure that these obligations are met and that PMSE users as a whole are not being significantly disrupted.
- 9.46 Our proposed approach to this is to put in place a focused annual audit of the band manager's performance against its obligations to PMSE users. This audit will be conducted by an independent third party.
- 9.47 We expect such an audit not only to look at the band manager's technical performance against its obligations but also to seek evidence from PMSE users to assess whether any significant disruption has been caused by its actions. Our view of the band manager's performance will be guided by this evidence as well as by evidence of whether the band manager has made efficient use of the spectrum awarded to it. We will have particular regard to the following questions:
- is there evidence that the band manager is making above-normal profits from PMSE users? This may indicate that the band manager is using a pricing structure that, in places, is pricing significantly above prices that would otherwise be expected in a competitive market;
 - is there evidence that PMSE users have been willing to pay for available spectrum but have been denied access? This would be against the band manager's obligation to meet reasonable PMSE demand on FRND terms;
 - is there evidence that PMSE users cannot afford access to spectrum and have no alternatives available? This may indicate that individual prices are excessive, although we would need to have regard to other factors such as increases in the AIP element of fees and the band manager's administrative costs; and

- have service levels been so poor that PMSE users' ability to operate has been significantly impaired? This would directly affect our key objective of avoiding significant disruption to PMSE users.
- 9.48 We propose to publish our own assessment of the band manager's performance in respect of PMSE users as well as the annual independent audit. We expect that the band manager would want to enhance its reputation through having positive reports and thereby will have an additional incentive to meet its obligations to PMSE users.
- 9.49 We propose to initiate a formal, wider-ranging review, which would assess evidence of the band manager's general performance over time, every three years. It would also incorporate a review of AIP levels. The frequency of these reviews should allow the band manager to resolve more significant issues in consultation with PMSE users. However, we would intervene earlier if there was compelling evidence that the relationship between the band manager and PMSE users as a whole had broken down to the extent that the band manager was failing to meet its obligations effectively.
- 9.50 Where we find evidence that the band manager is failing to meet its obligations to PMSE users, we can take appropriate action. As well as our ability to take enforcement action in respect of breaches of particular licence conditions, we will also retain the right to vary or revoke the band manager's licence on spectrum-management grounds, giving notice of our intention to do so in accordance with the timescales set out in section 6.
- 9.51 A decision to vary or revoke the band manager's licence would not be taken lightly. Although we cannot decide in advance how we would exercise our powers to vary or revoke in particular circumstances, we believe that in general it would only be appropriate to do so where:
- any problems could be shown to be widespread, sustained and causing significant damage to the long-term interests of PMSE users;
 - the band manager and PMSE users had made sufficient effort to resolve the problems and no other course of action was viable;
 - the revocation or variation of the band manager's licence would further our statutory duties (including our spectrum-management duties and any other relevant duties, such as the duty to secure the availability of a wide range of electronic communications services throughout the UK); and
 - we had fully consulted.

Question 41. Do you agree with our proposals concerning disputes between the band manager and PMSE users as a whole?

Disputes with individual PMSE users

- 9.52 We appreciate that individual PMSE users will be concerned about the level of protection that will be afforded to them in their day-to-day dealings with the band manager. The first level of protection will be provided by the structural measures that we propose to implement to ensure that the band manager will meet their needs. These are principally:
- selecting the band manager through a beauty contest whose criteria would include commitment to PMSE users;

- obligations on the band manager to adhere to pricing practices and service levels that avoid significant disruption to PMSE users;
 - annual audits of the band manager's performance;
 - three-yearly formal reviews of the band manager's performance with specific reference to the progress that PMSE users have made in their transition to a market-based approach to spectrum; and
 - a relatively short notice period of one year for varying or revoking the band manager's licence in respect of bands currently used for PMSE.
- 9.53 As a second level of protection, we propose that, as part of the application process, each applicant should outline proposals for an internal disputes-resolution procedure to deal with complaints from individual PMSE users. We envisage that disputes are likely to arise in relation to pricing, spectrum access and service levels. The commitments that the successful applicant makes in relation to these three areas and how it will deal with complaints from users will be enshrined in the licence that will be awarded. This is discussed in further detail in section 7.
- 9.54 This obligation will need to be clear and specific in how the band manager will behave toward PMSE users on a day-to-day basis so that it should be reasonably easy to determine whether it has met its obligations. We therefore envisage that it will contain key performance indicators enabling us to benchmark actual performance against the commitments made during the selection process.
- 9.55 Where a dispute cannot be resolved between the band manager and an individual PMSE user, we propose that the band manager should commit to using independent ADR. We believe that this approach would be a highly desirable way of swiftly and effectively resolving otherwise intractable disputes.
- 9.56 If the band manager is in dispute with a PMSE user, we will expect it to meet all pre-existing contractual obligations, including providing spectrum access, until the dispute is resolved.
- 9.57 Although we cannot decide in advance how we would exercise our powers in particular circumstances, in general we do not believe it would be appropriate for us to micromanage disputes between the band manager and individual PMSE users, nor do we think that continued regulatory involvement of this kind is consistent with the transition to a market-based approach to spectrum access. We will expect all parties to make use of the dispute-resolution processes enshrined in the licence awarded to the successful applicant.
- 9.58 We envisage that we would only become involved in dispute resolution if there were general dissatisfaction among PMSE users with the way in which the band manager was operating or if there was a significant individual dispute that could not be resolved between the parties. Such general dissatisfaction could, for example, be expressed through the annual audit process.
- 9.59 The activities of the band manager will also be subject to the provisions of the Competition Act 1998, including the prohibition on abuse of a dominant position. We hold competition functions concurrently with the Office of Fair Trading for services relating to the communications sector.

Question 42. Do you agree with our proposals concerning disputes between the band manager and individual PMSE users?

Ensuring continuity of service for PMSE

9.60 The band manager will be able to return spectrum to us if it decides that it no longer wishes to make it available to users. We will therefore ask each applicant to make a commitment as part of the selection process to give reasonable notice of its intent to return spectrum. This will give us sufficient time to put in place alternative access arrangements to ensure continuity of service to PMSE users. This commitment will be enshrined in the band manager's licence.

Summary

9.61 In this section, we have set out our proposals for:

- the definition of what constitutes "reasonable" PMSE demand;
- how we envisage the band manager will meet this demand on FRND terms;
- how we expect PMSE demand to be met at major events; and
- resolving disputes between the band manager and PMSE users, both individually and as a whole.

Section 10

Next steps

- 10.1 This consultation, published on 31 July 2008, lasts for an 11-week period. The closing date for responses is 16 October 2008. Annex 1 describes how to respond to this consultation.
- 10.2 We expect to publish a second consultation document before the end of the year on issues not addressed in detail in this document, namely:
- the means by which the band manager will authorise PMSE and other users to access its spectrum;
 - detailed technical licence conditions; and
 - the levels of AIP that the band manager will pay.
- 10.3 We will also continue to work with the Crown Dependencies, who have expressed a desire to be included in the scope of this award.
- 10.4 When this consultation has closed, we will undertake a comprehensive review of responses and factor this into our decision on the best way to progress this award in a timely and orderly fashion. We will then confirm next steps.
- 10.5 Table 5 sets out our current timetable for holding the band manager award.

Table 5. Timetable for the band manager award

31 July 2008	Consultation on detailed award design
16 October 2008	Consultation closes
Winter 2008	Second consultation
Spring 2009	Statement, information memorandum and draft regulations
Summer 2009	ITA
Autumn 2009	Licence awarded
Spring 2010	Band manager starts operating

- 10.6 We consider six months to be a reasonable estimate of how long it will take the band manager to start operating after the licence is awarded, taking into account the need for the successful applicant to make all the necessary prior arrangements. We are interested in stakeholders' views on this issue.

Question 43. Do you agree with our estimate that the band manager will require six months from licence award until it begins operating?

Annex 1

Responding to this consultation

How to respond

- A1.1 We invite written views and comments on the issues raised in this document, to be made **by 5 p.m. on 16 October 2008**.
- A1.2 We strongly prefer to receive responses using the online web form at <http://www.ofcom.org.uk/consult/condocs/bandmngr/howtorespond/form> as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see annex 3) to indicate whether or not there are confidentiality issues. This response cover sheet is incorporated into the online web-form questionnaire.
- A1.3 For larger consultation responses – particularly those with supporting charts, tables or other data – please email DDRBandManager@ofcom.org.uk, attaching your response in Microsoft Word format, together with a consultation response cover sheet.
- A1.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.
- DDR Band Manager Project Team
Spectrum Policy Group
Third Floor
Riverside House
2a Southwark Bridge Road
London SE1 9HA
- Fax: 020 7783 4303
- A1.5 Note that we do not need a hard copy in addition to an electronic version. We will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.
- A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together in annex 3. It would also help if you can explain why you hold your views and how our proposals would impact on you.

Further information

- A1.7 If you want to discuss the issues and questions raised in this consultation or need advice on the appropriate form of response, please contact Steve Roper on 020 7981 3027.

Confidentiality

- A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt. If you think your response should be kept confidential, please specify what part and why. Please also place such parts in a separate annex.

- A1.9 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and try to respect it. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.
- A1.10 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to us to use. Our approach to intellectual property rights is explained further on our website at www.ofcom.org.uk/about/accoun/disclaimer/.

Next steps

- A1.11 Following the end of the consultation period, we intend to publish a second consultation later this year.
- A1.12 Please note that you can register to receive free email updates alerting you to the publication of relevant Ofcom documents. For more details, please see www.ofcom.org.uk/static/subscribe/select_list.htm.

Our consultation processes

- A1.13 We seek to ensure that responding to a consultation is easy as possible. For more information, please see our consultation principles in annex 2.
- A1.14 If you have any comments or suggestions on how we conduct our consultations, please call our consultation helpdesk on 020 7981 3003 or email us at consult@ofcom.org.uk. We would particularly welcome thoughts on how we could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.
- A1.15 If you would like to discuss these issues or our consultation processes more generally, you can alternatively contact Vicki Nash, Director Scotland, who is our consultation champion:

Vicki Nash
Ofcom
Sutherland House
149 St. Vincent Street
Glasgow G2 5NW

Tel: 0141 229 7401
Fax: 0141 229 7433

Email vicki.nash@ofcom.org.uk

Annex 2

Our consultation principles

A2.1 We have published the following seven principles that we will follow for each public written consultation.

Before the consultation

A2.2 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

A2.3 We will be clear about whom we are consulting, why, on what questions and for how long.

A2.4 We will make the consultation document as short and simple as possible. 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 Plain English Guide for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will consult for up to 10 weeks depending on the potential impact of our proposals.

A2.6 A person within Ofcom 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. Our consultation champion will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why.

After the consultation

A2.8 We think it is important for everyone interested in an issue to see the views of others during a consultation. We will usually publish all the responses we have received on our website. In our statement, we will give reasons for our decisions and an account of how the views of those concerned helped shape them.

Annex 3

Consultation response cover sheet

- A3.1 In the interests of transparency and good regulatory practice, we will publish all consultation responses in full on our website: www.ofcom.org.uk.
- A3.2 We have produced a cover sheet for responses (see below) and would be very grateful if you could send one with your response. (It is incorporated into the online web form if you respond in this way.) This will speed up our processing of responses and help to maintain confidentiality where appropriate.
- A3.3 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, we would encourage respondents to complete their cover sheet in a way that allows us to publish their responses upon receipt rather than waiting until the consultation period has ended.
- A3.4 We strongly prefer to receive responses via the online web form, which incorporates the cover sheet. If you are responding via email, post or fax, you can download an electronic copy of this cover sheet in Word or RTF format from the consultations section of our website at www.ofcom.org.uk/consult/.
- A3.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details or job title to remain confidential, please provide them in your cover sheet only so that we do not 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

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing Name/contact details/job title

Whole response Organisation

Part of the response If there is no separate annex, which parts?

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

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard email text about not disclosing email contents and attachments.

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

Name

Signed (if hard copy)

Annex 4

Consultation questions

Executive summary

Question 1. The executive summary sets out our proposals for the DDR band manager award. Do you agree with these proposals?

Spectrum to be awarded

Question 2. Do you agree with our proposal to award access rights to channel 38 that will last as long as we sustain the protection of radioastronomy in the UK?

Question 3. Do you agree with our proposal to include the interleaved spectrum in channels 61 and 62 in the cleared award?

Question 4. Do you have any views on our proposed approach to protecting reception of DTT services?

Question 5. Do you agree with our proposal not to award the bands between 11.7 GHz and 12 GHz to the band manager?

Question 6. Do you agree with our general approach of awarding the remaining 49 Ofcom-managed bands allocated to PMSE but lying outside the digital dividend to the band manager?

Question 7. Do you agree with our proposal to award key PMSE bands to the band manager?

Question 8. Do you agree with our proposal to award 2290-2300 MHz to the band manager on the same terms as other wireless-camera channels at 2 GHz?

Question 9. Do you agree with our proposal to award low-demand PMSE bands to the band manager?

Question 10. Do you agree with our proposal to award no-demand PMSE bands to the band manager?

Question 11. Are there any other types of DTT transmission that should be protected from potential cognitive devices or other factors that we should take into account?

Question 12. Are there any potential future PMSE applications other than currently available wireless microphones, in-ear monitors and talkback systems that you consider should be protected from potential cognitive devices?

Question 13. Is there sufficient evidence to require protection for other services such as mobile television, bearing in mind the potentially negative implications of such protection for deploying cognitive devices?

Question 14. Do you have any views on the appropriate notice period for temporary PMSE access to channels 63-68 and/or on whether we should extend temporary access to channels 31-40?

Licence duration

Question 15. Do you agree with our proposal that the licence to be awarded should have an indefinite duration?

Question 16. Do you agree with our proposal that the licence to be awarded in respect of bands currently used for PMSE should be subject to no initial period?

Question 17. Do you agree with our proposal that the licence to be awarded in respect of bands currently used for PMSE should be subject to a notice period for variation or revocation on spectrum-management grounds of one year?

Question 18. Do you agree with our proposed approach to allowing the new institutional arrangements for PMSE spectrum access to bed down?

Question 19. Do you agree with our proposal that the licence to be awarded in respect of bands with no current PMSE use should be subject to no initial period?

Question 20. Do you agree with our proposal that the licence to be awarded in respect of bands with no current PMSE use should be subject to a notice period for variation or revocation on spectrum-management grounds of five years?

Question 21. Do you agree with our proposals for varying or revoking the band manager's licence during the notice period?

Question 22. Are there bands where PMSE users require earlier certainty about longer-term access in the interests of promoting spectrum efficiency than our timetable for the band manager award allows?

Award design and process

Question 23. Do you agree with our proposals for the three selection criteria by which we will assess applications for the licence to be awarded?

Question 24. Do you agree with our proposal to enshrine the commitments to PMSE users made by the successful applicant in the licence awarded to it?

Question 25. Do you agree with our proposed approach to assessing applications?

Licence conditions

Question 26. Do you agree with our proposal to use the block-edge mask approach to determine the technical licence conditions relevant to this award and to base these masks broadly on existing arrangements for PMSE spectrum access?

Question 27. Do you agree with our proposal to set a separate fee for each Ofcom-managed band to be awarded?

Question 28. Do you agree with our proposal initially to set fees for access to MOD-managed spectrum on a comparable basis?

Question 29. Do you agree with our proposal to determine the band manager's licence fee first by deriving estimates of the opportunity costs of the spectrum to be awarded?

and second by setting band-by-band prices that strike an appropriate balance between our objectives for this award?

Question 30. What are your views on the options for phasing in AIP to full opportunity cost?

Question 31. Do you agree with our proposal to set the band manager's licence fee for three years and to review it after that period?

Question 32. Do you agree with our proposal to review the band manager's licence fee periodically but no more frequently than every three years thereafter?

Question 33. Do you agree that where the interleaved spectrum to be awarded to the band manager is used for the operation of a DTT multiplex, we should replicate the ownership restrictions in the Broadcasting Act regime relating to (a) local authorities, (b) political bodies, (c) religious bodies and (d) bodies exerting undue influence but not replicate restrictions relating to (e) broadcasting bodies and (f) advertising agencies?

Question 34. Do you agree that we should facilitate interoperability between existing DTT multiplex operators and new operators using the interleaved spectrum awarded to the band manager?

Question 35. What are the merits of our proposed approach to providing spectrum information, in particular concerning the type of information that might be helpful and any impact that publishing information might have both on licensees and the wider spectrum market?

PMSE protection

Question 36. Do you agree with our assessment of whether our approach to awarding this spectrum appropriately promotes competition and efficiency?

Question 37. Do you agree with our proposal that "reasonable" PMSE demand for the spectrum awarded to the band manager should be defined as the actual demand from PMSE users at FRND prices?

Question 38. Do you agree with our proposals for ensuring that the band manager meets reasonable PMSE demand on FRND terms?

Question 39. Do you agree with our proposal to incorporate a suitable licence condition to enable us to access the spectrum awarded to the band manager to meet the requirements of the London 2012 Olympic Games and Paralympic Games and the Glasgow 2014 Commonwealth Games?

Question 40. Do you agree with our proposed approach to spectrum access for other major events?

Question 41. Do you agree with our proposals concerning disputes between the band manager and PMSE users as a whole?

Question 42. Do you agree with our proposals concerning disputes between the band manager and individual PMSE users?

Next steps

Question 43. Do you agree with our estimate that the band manager will require six months from licence award until it begins operating?

Annex 5

Impact assessment

Impact assessments are an important part of policy-making

- A5.1 The analysis presented in this annex represents an impact assessment, as defined in section 7 of the Communications Act 2003.
- A5.2 You should send any comments on this impact assessment to us by the closing date for this consultation. We will consider all comments before deciding whether to implement our proposals.
- A5.3 Impact assessments 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. This is reflected in section 7 of the Communications Act, which means that generally we have to carry out impact assessments where our proposals would be likely to have a significant effect on businesses or the general public or when there is a major change in our activities. However, as a matter of policy, we are committed to carrying out and publishing impact assessments in relation to the great majority of our policy decisions. For further information about our approach to impact assessments, see the guidelines “Better policy-making: Ofcom’s approach to impact assessment,” which are on our website at www.ofcom.org.uk/consult/policy_making/guidelines.pdf.

Introduction to our proposals

- A5.4 The proposals set out in this document address the future institutional arrangements for spectrum access for programme-making and special events (PMSE). They seek to implement the decisions set out in our December 2007 statement on the Digital Dividend Review (DDR) in practice. We assess the implications for not just PMSE users of the spectrum to be awarded to the band manager but also other potential users of this spectrum.
- A5.5 Generally speaking, we consider that the market is best placed to secure the optimal use of spectrum. In the long term, we would also expect this to be true for PMSE spectrum access. However, we have recognised that PMSE users face significant risks of market failure – and, indeed, impediments to market formation – that mean they are not currently able to take part in a market-based approach to spectrum.
- A5.6 The DDR statement set out the following decisions based on our assessment up to that point:
- we would award a single package of interleaved spectrum and channel 69 by beauty contest to a licensee who would act as a band manager;
 - to help PMSE users with the transition to market mechanisms, we would use criteria designed to ensure that the band manager’s interests were aligned with those of PMSE users;
 - the band manager would pay a charge for the spectrum based on Administered Incentive Pricing (AIP) and would be able to earn revenue by charging its customers for access;

- regulation would ensure that the band manager had to meet reasonable demand from PMSE users on fair, reasonable and non-discriminatory (FRND) terms. So long as these obligations were met, the band manager would be able to allow others to make use of its spectrum;
- the requirements to meet reasonable PMSE demand on FRND terms would last until 2018; and
- the band manager's licence would have indefinite duration. We proposed at that time that we would be able to vary or revoke it after a minimum term for spectrum-management reasons. This would enable us to take further steps to protect PMSE users if justified.

A5.7 This document sets out our detailed proposals for implementing these decisions, looking in particular at how our options score against four key objectives to be pursued in designing future arrangements for spectrum access by PMSE users:

- avoiding disruption to PMSE users that adversely affects their ability to provide a wide range of services to citizens, consumers and business customers;
- facilitating participation of the PMSE sector in a market-based approach to spectrum;
- promoting the optimal use of spectrum in relation to all potential users over time; and
- avoiding the risks of regulatory and market failure.

A5.8 This annex outlines our analysis in making the following key proposals for future PMSE spectrum access:

- how PMSE users will access spectrum that lies outside of the digital dividend;
- which spectrum outside the digital dividend to award to the band manager;
- how long the band manager will have secured access to spectrum;
- how frequently we will review AIP levels;
- how we will define "reasonable" PMSE demand; and
- how we will ensure the band manager meets reasonable PMSE demand on FRND terms where there is competing demand from other users.

How PMSE users will access spectrum that lies outside the digital dividend

A5.9 The DDR statement noted that we had made no decisions about including spectrum outside the digital dividend and currently used for PMSE in the package to be awarded to the band manager. This was because there were complex issues relating to spectrum usage rights that required further careful consideration and discussion. We stated we would consider this in detail when consulting on detailed award design.

A5.10 We assessed four options as the most plausible ways in which PMSE users could access spectrum that lies outside the digital dividend:

- option 1 – contract out spectrum management and licensing (similar to the current arrangement with JFMG – Joint Frequency Management Group);
- option 2 – take spectrum management and licensing in-house;
- option 3 – award one or more licences for this spectrum through a separate process; and
- option 4 – include this spectrum in the package to be awarded to the band manager.

Table A1. Options for PMSE access to spectrum outside the digital dividend

	Avoiding significant disruption to PMSE users	Facilitating a market-based approach	Promoting optimal use of spectrum	Avoiding regulatory and market failure
Option 1: contract out	<p><u>For</u>: may include all bands for future use</p> <p><u>Against</u>: against the wishes of PMSE users for one-stop shop</p>	<p><u>Against</u>: does nothing to move PMSE users to a market-based approach</p>	<p><u>Against</u>: little incentive to use spectrum more efficiently</p>	<p><u>Against</u>: risk of regulatory failure from command-and-control approach</p>
Option 2: take in-house	<p><u>For</u>: may include all bands for future use</p> <p><u>Against</u>: against the wishes of PMSE users for one-stop shop</p>	<p><u>Against</u>: does nothing to move PMSE users to a market-based approach</p>	<p><u>Against</u>: Ofcom not best placed to determine most efficient use of spectrum</p>	<p><u>Against</u>: risk of regulatory failure from command-and-control approach</p>
Option 3: separate award	<p><u>For</u>: may include all bands for future use</p> <p><u>Against</u>: against the wishes of PMSE users for a one-stop shop</p>	<p><u>For</u>: competition benefits from more than one supplier of spectrum</p> <p><u>For</u>: will move PMSE users to a market-based approach</p> <p><u>Against</u>: information flows hindered because more than one supplier of spectrum</p>	<p><u>Against</u>: possible insufficient economies of scale and scope to realise efficiencies</p>	<p><u>Against</u>: risk of market failure if each band manager has insufficient spectrum to realise efficiencies</p>

	Avoiding significant disruption to PMSE users	Facilitating a market-based approach	Promoting optimal use of spectrum	Avoiding regulatory and market failure
Option 4: award to band manager	<p><u>For</u>: may include all bands for future use</p> <p><u>For</u>: consistent with the wishes of PMSE users for a one-stop shop</p>	<p><u>For</u>: will move PMSE users toward a market-based approach</p> <p><u>Against</u>: loses the potential competition benefits from more than one supplier of spectrum</p>	<p><u>For</u>: maximum economies of scale and scope to realise efficiencies</p>	<p><u>For</u>: risks minimised by maximum economies of scale and scope to realise efficiencies and improve information flows</p>

A5.11 We favoured option 4 as, on balance, it scores best against all four objectives for future PMSE spectrum access.

Which spectrum outside the digital dividend to award to the band manager

A5.12 The assessment above indicated that we should, in principle, award spectrum outside the digital dividend to the band manager. However, these bands differ in their defining characteristics, who uses them, the equipment that is used and the services that are provided. They also differ in their strategic importance to PMSE users. We therefore assessed the case for awarding them to the band manager against our four key objectives for future PMSE spectrum access.

A5.13 We categorised bands based on the level of demand for them by PMSE users. They fell into three broad but distinct groups:

- key PMSE bands;
- low-demand PMSE bands; and
- no-demand PMSE bands.

Table A2. Whether to award spectrum outside the digital dividend to the band manager

	Pros	Cons
Key bands	Avoids significant disruption to PMSE users	May deny access to more valuable uses of this spectrum
Low-demand bands	<p>Avoids some disruption to PMSE users</p> <p>Increases the band manager's scope to move users from higher- to lower-cost spectrum over time</p> <p>Enhances the band manager's ability to provide pricing information to PMSE users</p>	May deny access to more valuable uses of this spectrum

	Pros	Cons
No-demand bands	<p>Increases the band manager's scope to move users from higher- to lower-cost spectrum over time</p> <p>Enhances the band manager's ability to provide pricing information to PMSE users</p> <p>Band manager is likely to respond to market signals better than we are</p>	<p>May deny access to more valuable uses of this spectrum</p> <p>Some risk of windfall profits if the band manager trades this spectrum. Mitigated by our oversight of trades to avoid significant disruption to PMSE users. Windfall profits would also tend to suggest the spectrum was moving to a more valuable use</p>

A5.14 On balance, we considered that we would be meeting our key objectives most effectively by proposing to award all bands outside the digital dividend to the band manager. We were particularly mindful of the increase scope that the band manager would have to manage future shifts in PMSE demand caused by changing pricing signals reflecting rises in AIP.

A5.15 We also believed that this arrangement would help to overcome one of the key barriers to the development of a market for PMSE access to spectrum – a lack of information flowing between suppliers and users of spectrum. By awarding all the bands currently allocated to PMSE to the band manager (with specific exceptions as outlined in section 5), we would be increasing the band manager's ability to pass on information about all the bands available to PMSE users.

How long the band manager will have secured access to spectrum

A5.16 We approached this assessment on the premise that, as set out above, all bands currently allocated to PMSE would (with specific exceptions) be awarded to the band manager.

A5.17 We proposed in the DDR statement that the band manager would have an indefinite licence with a 10-year minimum term, subject to variation or revocation on five years' notice. However, we reflected further on this approach given the possibility of the band manager failing to meet its obligations to PMSE users effectively.

Bands currently used for PMSE

A5.18 We considered that we needed to give more security to PMSE users in bands currently used for PMSE by ensuring that we can intervene promptly if the band manager fails to meet its obligations to them effectively. To do so, we proposed to maintain the indefinite licence period but decided that a minimum period could be effected by having a defined notice period, which may be shorter in duration than the 10-year minimum term originally proposed.

A5.19 Our assessment focused on a notice period of either one year or five years, with five years being the maximum plausible period before intervening where we considered such action necessary.

Table A3. Notice period for bands currently used for PMSE

	Pros	Cons
One-year notice period	<p>Marginal improvement on the tenuous nature of access currently enjoyed by PMSE users</p> <p>Allows us to intervene promptly where we identify that the band manager is failing to meet its obligations to PMSE users effectively</p>	<p>Perceived lack of security for the band manager in developing long-term plans for PMSE users</p> <p>Perceived lack of security for the band manager in making any up-front investments</p>
Five-year notice period	<p>Significant improvement on the tenuous nature of access enjoyed by PMSE users</p> <p>Gives the band manager sufficient time to realise any spectrum efficiencies that it identifies</p> <p>Gives the band manager sufficient time to recoup any up-front investments</p>	<p>May give us insufficient scope to intervene where the band manager is failing to meet its obligations to PMSE users effectively</p>

A5.20 We considered that, for these bands, the balance of our approach should favour ensuring that PMSE users did not suffer significant disruption. This is particularly important as these bands are often critical to PMSE users, not least as there are no identifiable alternatives to many of these bands in the short term to medium term.

A5.21 We therefore considered that there was a compelling case for the notice period to be set at one year. If the band manager meets its obligations to PMSE users, the indefinite licence period will provide sufficient time for it to realise any efficiencies in the use of spectrum it identifies, particularly for existing PMSE users. Similarly, we also believed that the indefinite licence period would offer sufficient security for the band manager to recoup any up-front costs that it incurs, again assuming it continues to meet its obligations to PMSE users.

Bands where there is no current PMSE use

A5.22 In the case bands where there is no current PMSE use, there is no risk of disruption to PMSE users if they do not have access. However, our other objectives are still important to how the band manager uses this spectrum.

A5.23 We envisage that the band manager will need time to develop this spectrum. It will likely want to identify future uses that are suitable for these bands, possibly identify potential customers who could use this spectrum and make commercial arrangements that realise its best value. Alternatively, it may want to encourage PMSE use of these bands where this would be more efficient than continued use of bands currently used for PMSE.

A5.24 This type of planning would likely take longer than the one-year notice period proposed for bands currently used for PMSE. However, we also wanted to strike a balance with our ability to intervene where it was clear that spectrum was not being used efficiently over a period of time.

A5.25 We considered a period of one year (consistent with those bands currently used for PMSE demand), five years and until 2026 (as argued by some PMSE users) against our objectives:

Table A4. Notice period for bands where there is no current PMSE use

	Pros	Cons
One-year notice period	<p>Marginal improvement on the tenuous nature of access currently enjoyed by PMSE users</p> <p>Allows us to intervene promptly where we identify that the band manager is failing to meet its obligations to PMSE users effectively (although the nature of these bands mean that this outcome is unlikely).</p>	<p>Perceived lack of security for the band manager in developing long-term plans for PMSE users</p> <p>Perceived lack of security for the band manager in making any up-front investments</p>
Five-year notice period	<p>Significant improvement on the tenuous nature of access currently enjoyed by PMSE users</p> <p>Gives the band manager sufficient time to realise any spectrum efficiencies that it identifies</p> <p>Gives the band manager sufficient time to recoup any up-front investments</p>	<p>May give us insufficient scope to intervene where the band manager is failing to meet its obligations to PMSE users effectively (although the nature of these bands mean that this outcome is unlikely)</p>
Until 2026	<p>Very significant improvement on the tenuous nature of access currently enjoyed by PMSE users</p> <p>Stated preference of PMSE users to ensure consistency with licence terms for existing DTT multiplexes</p>	<p>May give us insufficient scope to intervene where the band manager is failing to meet its obligations to PMSE users effectively (although the nature of these bands mean that this outcome is unlikely)</p> <p>Increased risk of regulatory failure if spectrum is not used efficiently over such a long period</p> <p>Likely to give the band manager more than sufficient time to realise any spectrum efficiencies that it identifies</p> <p>Likely to give the band manager more than sufficient time to recoup any up-front investments</p>

A5.26 The above assessment led us to propose that a five-year notice period would strike an appropriate balance between incentivising the band manager to plan to find the most efficient use of these bands while allowing us to intervene where we thought that most efficient use of the spectrum was not being realised.

How frequently we will review AIP levels

A5.27 We considered that a key feature of setting AIP was the provision to review the level at which it had been set. This was of particular importance in respect of our objective

to avoid the risks of regulatory and market failure. If we set the level of AIP too low, we risk not giving sufficient incentive to the band manager to find the most efficient use of spectrum and thereby increase the likelihood of regulatory failure. On the other hand, if we set AIP too high, we increase the risk that PMSE users will be unable to access spectrum and also the likelihood of market failure.

A5.28 We also wanted to ensure that the band manager had sufficient certainty to plan its business, which would mean giving it as much sight as possible of its future costs, including AIP.

A5.29 We considered three options for how frequently AIP should be reviewed: every year, every three years and every five years.

Table A5. Frequency of AIP reviews

	Pros	Cons
Every year	Allows us to make changes promptly where we have set the initial AIP at the wrong level, thereby avoiding either regulatory or market failure	Does not give sufficient certainty to the band manager to plan its business Very resource intensive for both us and the band manager
Every three years	Allows us to make changes to the initial AIP figure within a reasonably short period in light of further information that has emerged from the market Gives some certainty to the band manager to help it to plan its business	Band manager may perceive this to be insufficient to allow it to plan its business
Every five years	Significant certainty for the band manager in helping it to plan its business	Increased risk of either regulatory or market failure if we set the initial AIP at a wrong level

A5.30 We believed that the correct balance was met with three-yearly reviews.

How we will define “reasonable” PMSE demand

A5.31 We committed in the DDR statement to requiring the band manager to meet reasonable PMSE demand on FRND terms. At that time, we did not set out what we meant by “reasonable” demand. We assessed the options for defining this as follows.

Table A6. Definitions of “reasonable” PMSE demand

	Pros	Cons
Reserving spectrum based on current demand	Little disruption to PMSE users	Inefficient use of spectrum Significant difficulties in accommodating future demand profiles

	Pros	Cons
Reserving spectrum based on a forecast of future demand	Little disruption to PMSE users if the forecast is right	Inefficient use of spectrum Significant risk that the forecast will be wrong
Satisfying actual future demand at FRND prices	Takes into account future changes in demand, including those in response to spectrum pricing	Possibility of some short-term disruption depending on our approach to determining FRND pricing

A5.32 One of the key factors we needed to address in defining reasonable demand was that any definition would apply to future PMSE demand. This is because we expect that, as AIP is charged to the band manager, pricing signals will be felt by PMSE users that may make alternative spectrum (which is less valuable for other uses) relatively less expensive and more attractive to use where this is feasible. Basing demand on current PMSE use of spectrum would therefore be unsatisfactory and otherwise difficult to define.

A5.33 We therefore considered that defining reasonable demand as satisfying future actual demand at FRND prices was the most appropriate option.

How we will ensure the band manager meets reasonable PMSE demand on FRND terms where there is competing demand from other users

A5.34 This issue is of concern to PMSE users, who are keen to ensure that sufficient spectrum is available to meet their needs. This is particularly the case where non-PMSE users who wish to use the spectrum awarded to the band manager are better aware of the value of the spectrum to their business and, as a result, may have more financial strength than PMSE users. We were particularly mindful of our objective of avoiding significant disruption to PMSE users when assessing our options, of which we identified three.

Table A7. Meeting reasonable PMSE demand over competing non-PMSE demand

	Pros	Cons
Give PMSE users priority if they secure access in advance	Easily understood	May overly restrict the band manager’s ability to do business with non-PMSE users Disadvantages non-PMSE users who want to secure long-term access Inconsistent with current PMSE practice to secure access shortly before it is required

	Pros	Cons
Require the band manager to provide evidence it can meet its obligations to PMSE users	<p>Ensures licence obligations are met and significant disruption to PMSE users is avoided</p> <p>Keeps us in the loop</p>	<p>May be overly burdensome for the band manager</p> <p>Will be time-consuming and militate against quick access</p>
Require the band manager to provide evidence it can meet its obligations to PMSE users if it requests a variation of its technical licence conditions	<p>Ensures licence obligations are met and significant disruption to PMSE users is avoided</p> <p>Keeps us in the loop</p> <p>Consistent with our proposed approach to technical licence conditions, ensures there is little risk of disruption in the early period of the band manager's licence</p>	<p>May be overly burdensome for the band manager</p> <p>Will be time consuming and militate against quick access</p>

A5.35 On balance, we considered that the second and third options were both viable and would meet our requirement that reasonable PMSE demand be met where there was competing demand from non-PMSE users. Our proposals incorporated both options.

A5.36 In the first instance, we proposed that the band manager would have technical licence conditions suitable for PMSE use and would have to apply for a variation to these to enable it to facilitate non-PMSE use of the spectrum awarded to it. Subsequent to this, any further request from the band manager to facilitate non-PMSE use would be subject to its demonstrating it could still meet its obligations to PMSE users.

Annex 6

Approach to determining the opportunity cost of spectrum use

Introduction

- A6.1 This annex sets out the general approach we have used to determine the opportunity cost of the spectrum to be awarded to the band manager. We first explain the link between spectrum pricing and opportunity costs. Then we explain how we have tried to illustrate the potential level of the opportunity costs of the spectrum to be awarded to the band manager given the data and timing constraints we face.
- A6.2 The estimates provided in this document are illustrative only. We will undertake further work to make appropriate opportunity-cost estimates of all of the bands to be awarded to the band manager. We expect that these estimates will differ from those presented in this document, but we believe that the information provided here gives a useful indication of the potential magnitude of the opportunity-cost estimates and resulting licence fees.
- A6.3 The figures derived in this further work will help to determine the licence fees that we will propose to charge for the use of this spectrum. However, when setting licence fees, we will also have regard to our key objectives for future PMSE spectrum access:
- avoiding disruption to PMSE users that adversely affects their ability to provide a wide range of services to citizens, consumers and business customers;
 - facilitating participation of the PMSE sector in a market-based approach to spectrum;
 - promoting the optimal use of spectrum in relation to all potential users over time; and
 - avoiding the risks of regulatory and market failure.

Spectrum pricing and opportunity costs

- A6.4 The primary objective of opportunity-cost-based pricing is to improve the efficiency with which spectrum – a scarce resource – is managed. The approach we use to set spectrum prices is AIP. This approach has been developed over a number of years.
- A6.5 If spectrum is plentiful (i.e. everyone can get the amount of spectrum they want at the desired frequency), there is no need to ration spectrum. In this situation, spectrum management would focus on assigning spectrum so that there is no unwanted interference, and a fee would be levied to cover the cost generated by frequency coordination and allocation.
- A6.6 However, in many cases, spectrum is not plentiful. There is evidence of intense demand at some frequencies, especially those between 445 MHz and 2.5 GHz. As a result, despite significant effort in coordinating assignments, often not everyone gets as much spectrum as they want and/or requests for assignments have to be turned down. In some cases, spectrum may appear to be relatively plentiful when this is not in fact

the case. This sometimes occurs when spectrum is reserved for specific applications as the level of use may not reflect all the potential demand and so may wrongly convey the impression that the demand is not intense. In these cases, the level of demand that matters for efficiency considerations is demand from both existing and alternative potential users, whether for the same use or for different uses.

- A6.7 When the available spectrum is insufficient to meet the demand of all interested parties, there is a need to ration spectrum. In this situation, spectrum efficiency requires spectrum to be assigned to uses that generate the most value and to be held by users that value it the most. Spectrum pricing is an effective tool to help ensure that this happens and, hence, that spectrum ends up in the hands of those users who get the most value from it.
- A6.8 Spectrum prices can play this role because, like any other prices, they influence the choices made by users. Typically, a user is willing to pay a price for spectrum that reflects the benefits it gets from it. It will keep using spectrum as long as, at the margin, it derives more benefits than costs from doing so. If not, it will reduce the amount of spectrum it uses or consider more spectrally efficient technology or less congested frequency bands in order to reduce its spectrum costs so they are no longer higher than the benefits generated. This means that users' demand for, and use of, spectrum reflects the value they place on it after taking its price into account.
- A6.9 To ensure that spectrum is used efficiently when demand exceeds supply, all users must be willing to pay a price for spectrum that reflects the marginal value of the resource to the highest-value alternative user of that resource (i.e. the opportunity cost of their spectrum use on other potential users and uses). If they are willing to pay this much, we know that the value generated from the spectrum should not be higher if it were used by another party.
- A6.10 One approach to identifying the marginal value, or opportunity cost, of spectrum to an alternative user is to assess the impact of a marginal change in spectrum availability for that user. In practice, this is often estimated by answering the question: how much cost does the user avoid by holding on to a small, additional amount of spectrum while maintaining its production constant?⁵⁴ The user will be ready to pay a price that is, at most, equal to this marginal opportunity cost in order to gain access to spectrum.
- A6.11 To ensure that the spectrum is held by those who value it the most, we aim to set spectrum prices at a level that reflects the highest opportunity costs of spectrum among the various alternative uses and users. Since the opportunity cost varies depending on frequency, we need to calculate the opportunity cost for each frequency individually.

Approach to determining opportunity costs: general principles

- A6.12 Since we are proposing to award many bands to the band manager, we will calculate the opportunity cost for each.
- A6.13 Where, based on available evidence, the demand at current prices for a given band from existing, alternative, new and potential uses is low or can be easily met, the opportunity cost is likely to be low or zero. So, rather than estimating the opportunity

⁵⁴ This entails looking at the different mix of inputs (equipment and resource) that a representative user could choose to use to produce the same amount (but with slightly reduced spectrum) and estimating the corresponding production costs. The change in production costs resulting from a small reduction in spectrum use represents the marginal opportunity cost of spectrum. The marginal opportunity cost will depend on the input mix chosen. The user will be ready to pay a spectrum price, at most, as high as the lowest marginal opportunity cost.

cost, we would normally set a zero or nominal fee that would meet administrative licensing costs.

- A6.14 Conversely, where, based on available evidence, the demand for a given band from existing, alternative, new and potential uses is known, or likely, to outstrip the supply, we intend to set licence fees based on an AIP approach in order to efficiently ration spectrum. This requires us to estimate the opportunity cost of the spectrum for the various users and applications of the band.
- A6.15 In practice, we proceed with determining the opportunity cost of the spectrum in the band by taking the following steps:
- when the presence of PMSE users in the band denies access to other potential users, we identify these competing users. These can be other PMSE users – when there is congestion – or non-PMSE users interested in using the spectrum for alternative or new uses;
 - then we estimate the marginal opportunity cost of spectrum for each existing or potential user in that band by finding out how much each user would be willing to pay to gain access to a small amount of spectrum at that frequency;⁵⁵ and
 - finally we compare the opportunity costs of all the users and set the opportunity cost of the band to be equal to the highest estimated opportunity cost.
- A6.16 Given the uncertainty and potential error likely in estimates of opportunity costs, we generally derive a range of opportunity-cost figures and adopt a conservative approach when identifying the full opportunity cost toward which AIP fees will tend over time. This full opportunity cost is generally selected from the lower end of the estimated opportunity-cost range.

Approach to determining PMSE opportunity costs

- A6.17 There have been attempts at identifying an AIP to apply to PMSE use of spectrum. The methodology reviewed by NERA and Smith System calculated what this might be, mainly by applying (with some adjustments) the STU for business mobile radio to PMSE use of spectrum below 2 GHz and the STU for fixed links to PMSE use of spectrum above 2 GHz. However, the report signalled that introducing AIP would be difficult due to some features of the PMSE sector, in particular the highly diverse use and intense sharing of spectrum. The report by Indepen, Aegis and Warwick Business School briefly revisited the issue. We decided not to proceed with introducing AIP in view of the expected changes to be faced by PMSE users, including DSO.
- A6.18 This time around, we believe it is appropriate to set licence fees based on an AIP approach for the spectrum to be awarded to the band manager by beauty contest. However, at this point in the award process, it is difficult to identify accurate fee levels. This is, in part, because:
- there is a lack of reliable data, in particular concerning the opportunity costs of PMSE use of spectrum; and

⁵⁵ It is possible that spectrum users delivering similar services may face different opportunity costs. This happens if the way to compensate for a reduction in spectrum varies with individual circumstances. In this case, the standard approach is to derive a “representative” opportunity cost that is a weighted average of the different individual opportunity costs, where the weights represent the likelihood of these circumstances.

- there is a lot of uncertainty about which alternative users need to be considered as competing with PMSE users. This may be partly resolved after the other DDR awards have taken place.

A6.19 Notwithstanding these practical difficulties, it is important that we start signalling the value of the band manager's licence fee to PMSE users, who are keen to have an early indication. Set out below are our first indicative opportunity-cost estimates for key bands for which we believe or anticipate demand from all interested parties would outstrip supply at prevailing licence-fee levels.

A6.20 These illustrative estimates adopt a pragmatic approach to determining the potential opportunity cost for these bands. We use the best available information on existing and potential competing uses. We rely on existing STUs whenever we believe that they would fit well with the identified competing uses. We also attempt to build rough opportunity-cost estimates for existing use when we consider this to be necessary – mainly in the case of congestion (i.e. when the competing users are also PMSE users) – and there is no corresponding STU available.

A6.21 The estimates provided in this document are illustrative only. We will undertake further work to make appropriate opportunity-cost estimates of all of the bands to be awarded to the band manager. We expect that these estimates will differ from those presented in this document, but we believe that the information provided here gives a useful indication of the potential magnitude of the opportunity-cost estimates and resulting licence fees.

A6.22 In setting the licence fees, we will take into account responses to our proposals for introducing AIP set out in this document.

A6.23 We emphasise at this stage that the opportunity-cost calculations should not be interpreted as indicative of the AIP fees that will initially be set for the spectrum to be awarded to the band manager. The opportunity-cost figures will inform the fee levels we set by indicating the value the fees will tend to, and should be reaching, over the years.

A6.24 Also, we intend to review opportunity-cost calculations after three years, when the DDR awards should have taken place and market value information should have started emerging as a result of the change toward a more market-based approach.

A6.25 Before providing examples of how we calculate opportunity-cost estimates, we list the bands for which we have not made estimates.

Opportunity-cost estimates

A6.26 To date, we have focused on identifying illustrative estimates of opportunity cost for the following key PMSE bands:

- interleaved spectrum;
- channel 69;
- talkback channels in UHF bands I and II; and
- 2 GHz.

A6.27 In the following paragraphs, we explain how we derive a first indicative estimate of the opportunity costs for these bands. As mentioned earlier, further work is required to arrive at final opportunity-cost estimates.

Interleaved spectrum

A6.28 Our understanding of the characteristics of interleaved spectrum suggests that the existing and potential demand outstrips supply for some frequencies:

- our preparatory work for the geographic interleaved awards identifies various competing uses. Some of the losing bidders may approach the band manager as an alternative way to satisfy their spectrum needs; and
- previous work on pricing spectrum for PMSE identified business mobile radio users as interested in obtaining access to some of these frequencies. Due to broadcasters' presence and the resultant obligation not to interfere with transmissions, business mobile radio on-site applications of up to 1 W e.r.p. could be viewed as a competing use and could be deployed in these white spaces.

A6.29 After the geographic interleaved awards, we will have market information that could inform our assessment of the opportunity cost of this use. The losing bidders from these awards are likely to give us further information about who the other potential users of interleaved spectrum are. These users may be keen to source their spectrum from the band manager.

A6.30 As this information is not currently available, we have focused on determining the opportunity costs of interleaved spectrum by assessing the opportunity cost for mobile radio users.

A6.31 In our statement on modifications to spectrum pricing, we compared current PMSE fees and an AIP fee based on business mobile radio use, although neither sought to fully reflect underlying opportunity costs. This comparison suggested that PMSE fees were three to four times lower than the level of AIP fees at that time. Hence, we have used this benchmark to provide an indication of a possible lower bound for opportunity costs in this spectrum for the purposes of setting AIP for interleaved spectrum. The current fees for this spectrum paid to JFMG by licensees are in the region of £300k per year, which would suggest that a fee based on opportunity cost may be at least £900k per year. Another potential alternative use is DTT, more information on the value of which might be revealed as a result of the geographic interleaved awards. This may or may not imply a higher opportunity cost than that based on business mobile radio.

Channel 69

A6.32 Our present understanding is that cellular operators may have the highest opportunity cost for access to this spectrum. Previous work to assess the opportunity costs of spectrum for mobile operators have led to setting the STU at around £350k per MHz per year for cellular applications at 900 MHz using GSM technology.

A6.33 Keeping in mind our pragmatic approach, we consider it appropriate at this stage to use this cellular STU to derive a reasonable proxy for a first indicative opportunity cost for channel 69.

A6.34 We multiply the cellular STU by eight to obtain a figure for the entire channel, giving a figure of about £2.8m as a first indicative lower-bound opportunity cost for the spectrum.

- A6.35 We believe that this is a conservative estimate of the opportunity cost of channel 69. First, this estimate is based on the STU for 900 MHz using existing GSM technologies. In the future, this spectrum may be liberalised to allow other public mobile communications technologies. The value of liberalised 900 MHz spectrum may be significantly higher. Second, we have considered channel 69 in isolation. If its use were considered in combination with the adjacent cleared spectrum, its opportunity cost may be significantly greater. Channel 69 could be very valuable to those who win this cleared spectrum or part thereof as it may increase the options for deploying public cellular mobile networks. We are not in a position at this stage to identify this winner or the use to which this combined spectrum could be put, but we expect that this opportunity cost might be greater than when any channel is considered in isolation.
- A6.36 The above considerations indicate that an opportunity cost of £2.8m is likely to be a lower-bound estimate.

Talkback channels in UHF bands I and band II

- A6.37 We are aware that the opportunity cost of these talkback channels can be approached in two ways:
- by looking at the opportunity costs for talkback users who cannot access these bands due to heavy use. This is especially true in band II; or
 - by considering the opportunity costs for other users, most likely to be low-power business mobile radio.
- A6.38 Due to timing and resource constraints, our initial estimate has been derived using the latter approach. Hence, as with interleaved spectrum, we have derived indicative estimates of the opportunity cost of these bands based on the assumption that the most likely alternative use of the spectrum is business mobile radio. Using the same approach set out above for interleaved spectrum suggests that a fee based on a lower bound of this opportunity cost could be around three to four times the current fee level.
- A6.39 In band I, the current fees paid to JFMG by licensees are in the region of £95k per year. This suggests that a fee based on the lower-bound opportunity cost could be around £280k per year for the 1.84 MHz of spectrum allocated to PMSE.
- A6.40 For band II, the current fees paid to JFMG by licensees are in the region of £250k per year. This suggests that a fee based on the lower-bound opportunity cost could be around £750k per year.

2 GHz

- A6.41 We have proposed awarding access to about 300 MHz of spectrum at 2 GHz to the band manager. Much of this is managed by the MOD and used for PMSE – mainly wireless cameras – on a secondary basis.
- A6.42 Our initial investigation of opportunity cost for spectrum used by PMSE at 2 GHz suggests that alternative uses (e.g. fixed links) are unlikely to materialise due to difficult technical conditions (a combination of interference issues and lack of material). However, there seems to be congestion in about 70% of the spectrum.
- A6.43 Therefore, to identify an illustrative estimate of opportunity costs for this spectrum, we have estimated the opportunity costs that a typical existing PMSE user would face if its spectrum was marginally reduced. Our understanding is that the user would most likely

be inclined to consider using spectrum at 7 GHz and buying wireless-camera equipment to work at that frequency. There is also the possibility of relying on satellite connection (e.g. Inmarsat) and subscribing to the service after buying the appropriate equipment. However, this does not seem to be the preferred option in most cases as it is more expensive and delivers lower quality. We have derived our initial illustrative opportunity-cost estimate as a weighted average of these two opportunity costs.

A6.44 Our initial indicative estimate of the opportunity cost of using a wireless camera at 7 GHz amounts to about £725 per MHz (i.e. around £7,250 for a 10 MHz channel) per year. This is derived as the annualised cost of acquiring 7 GHz equipment, assuming this equipment has a 10-year life span, using the following assumptions:

- the wireless-camera equipment and accessories for operation at 7 GHz cost £30k;
- every year, maintenance costs amount to 10% of the initial equipment and accessories cost; and
- a discount rate of 10% is used.

A6.45 Our initial indicative estimate of the opportunity cost of using satellite connection amounts to about £3,450 per MHz (or around £34,500 for a 10 MHz channel) per year. This is derived as the annualised cost of acquiring satellite equipment, assuming the equipment has a 10-year life span, using the following assumptions,:

- the equipment and accessories cost in the region of £2,200;
- an Inmarsat BGAN satellite-connection service, streaming at 256 kilobits per second, is required for about 300 minutes per month and the monthly charges for this service are the BGAN fees listed by BT of £22.20 subscription and £9.40 per minute access;
- every year. maintenance costs amount to 10% of initial equipment and accessories costs; and
- a discount rate of 10% is used.

A6.46 The lower-bound opportunity cost for a 10 MHz channel at 2 GHz would be £7,250 per year when the weight put on wireless cameras at 7 GHz varies between 0% and 1% in the weighted average of these two input opportunity-cost estimates. This translates into an annual opportunity cost of about £725 per MHz or around £150k for the 210 MHz of spectrum assessed as congested for PMSE use at 2 GHz.

Annex 7

Spectrum currently allocated for PMSE

Band (MHz)	Primary Use	Award to band manager proposed?	Managed by
47.55-48.8	Audio	Yes	Ofcom
52-52.95	Audio	Yes	Ofcom
53.75-55.75	Audio	Yes	Ofcom
60.75-62.75	Audio	Yes	Ofcom
67.75-67.8375	Audio	Yes	Ofcom
69.15625-69.18125	Audio	Yes	Ofcom
74.68125-74.71875	Audio	Yes	Ofcom
75.2625-75.3	Audio (airborne use permitted)	Yes	MOD
76.80625-76.84375	Audio	Yes	Ofcom
78.18375-78.25875	Audio	Yes	MOD
82.65625-82.68125	Audio	Yes	Ofcom
86.66875-86.68125	Audio (geographic restrictions apply)	Yes	Ofcom
86.80625-86.84375	Audio (some airborne use permitted, restrictions apply)	Yes	Ofcom
139.54375-139.55625	Audio (geographic restrictions apply)	Yes	Ofcom
139.56875-139.58125	Audio (geographic restrictions apply)	Yes	Ofcom
139.64375-139.66875	Audio (geographic restrictions apply)	Yes	Ofcom
140.9875-141.4875	Audio (geographic restrictions apply, some airborne use permitted, restrictions apply)	Yes	Ofcom
148.5625-148.5875	Audio (geographic restrictions apply)	Yes	Ofcom
148.7125-148.7375	Audio (geographic restrictions apply)	Yes	Ofcom

Band (MHz)	Primary Use	Award to band manager proposed?	Managed by
175.15-175.35	Wireless-microphone use only. Geographic restrictions apply	Yes	Ofcom
175.425-175.625	Wireless-microphone use only. Geographic restrictions apply	Yes	Ofcom
176.3-176.5	Wireless-microphone use only. Geographic restrictions apply	Yes	Ofcom
176.5-176.9	Wireless-microphone use only. Geographic restrictions apply	Yes	Ofcom
176.9-177.1	Wireless-microphone use only. Geographic restrictions apply	Yes	Ofcom
181.69375-181.80625	Audio links and data links	Yes	Ofcom
184.5-185.1	Wireless-microphone use only	Yes	Ofcom
189.69375-189.80625	Audio links and data links	Yes	Ofcom
191.6-191.8	Includes use by links and wireless microphones	Yes	Ofcom
191.8-192	Wireless-microphone use only	Yes	Ofcom
192-193.1	Wireless-microphone use only	Yes	Ofcom
199.6-200.2	Includes use by links and wireless microphones. Restrictions apply for links	Yes	Ofcom
200.2-201.1	Wireless-microphone use only	Yes	Ofcom
207.6-210.1	Audio	Yes	Ofcom
425.3125-425.5625	Audio (geographic restrictions apply)	Yes	MOD
427.7625-428.0125	Audio (geographic restrictions apply)	Yes	MOD
442.2625-442.5125	Audio (geographic restrictions apply)	Yes	MOD
446.425-447.5125	Audio (power restrictions apply in certain geographic areas)	Yes	MOD
454.9875-455.475	Audio (geographic restrictions apply, some airborne use permitted, restrictions apply)	Yes	Ofcom
457.25-457.475	Audio (some airborne use permitted, restrictions apply)	Yes	Ofcom
461.23125-461.25625	Audio (some airborne use permitted, restrictions apply)	Yes	Ofcom

Band (MHz)	Primary Use	Award to band manager proposed?	Managed by
462.75-463	Audio (some airborne use permitted, restrictions apply, power restrictions apply)	Yes	Ofcom
467.2625-469.875	Audio (geographic restrictions apply, some airborne use permitted, restrictions apply)	Yes	Ofcom
470-590	Includes use by links and wireless microphones. Restrictions apply	Partial (550-590 MHz removed)	Ofcom
590-598	Wireless-microphone use only (geographic restrictions apply)	No	Ofcom
598-606	Audio (restrictions apply)	No	Ofcom
606-614	Wireless-microphone use only (restrictions apply)	No	Ofcom
614-854	Includes use by links and wireless microphones. Restrictions apply.	Partial (614-630, 806-854 MHz removed)	Ofcom
854-862	Wireless microphones and audio links (airborne use permitted)	Yes	Ofcom
1517-1525	Audio	Yes	Ofcom
1785-1800	1790-1798 to be coordinated with Ofcom and Scottish Government. Digital wireless-microphone use only	Yes	Ofcom
2025-2110	Wireless cameras (used on the basis of no interference to MOD in 2025-2070 MHz)	Yes	Ofcom/ MOD
2200-2300	Wireless cameras (used on the basis of no interference to MOD in 2200-2245 MHz)	Yes	Ofcom/ MOD
2390-2450	Wireless cameras	Yes	MOD
2450-2690	Wireless cameras (2500-2690 MHz unavailable after 1 September 2008)	Partial (2500-2690 MHz removed)	Ofcom
3400-3440	Video links (geographic restrictions apply, some airborne use permitted)	Yes	MOD
3500-3580	Video links (geographic restrictions apply, some airborne use permitted)	Yes	MOD
5472-5588	Video links (geographic restrictions apply)	Yes	MOD
5682.5-5702.5	Video links (geographic restrictions apply, some airborne use permitted)	Yes	MOD
5705-5725	Video links (geographic restrictions apply)	Yes	MOD
5732.5-5752.5	Video links (geographic restrictions apply)	Yes	MOD

Band (MHz)	Primary Use	Award to band manager proposed?	Managed by
5770-5790	Video links (geographic restrictions apply, some airborne use permitted)	Yes	MOD
5795-5815	Video links (geographic restrictions apply)	Yes	MOD
5850-5925	Video links (geographic restrictions apply, some airborne use permitted)	Not decided	Ofcom
7110-7250	Video links (geographic restrictions apply, some airborne use permitted)	Yes	Ofcom
7300-7425	Video links	Yes	Ofcom
8460-8500	Video links (geographic restrictions apply)	Yes	Ofcom
10300-10360	Video links (geographic restrictions apply, some airborne use permitted)	Yes	MOD
117366-117566	Low-power camera links	No	Ofcom
118133.8-11833.8	Low-power camera links	No	Ofcom
11890.1-11910.1	Low-power camera links	No	Ofcom
119668.2-119868.2	Low-power camera links	No	Ofcom
12200-12500	Video links	Yes	Ofcom
24250-24500	Video links	Yes	Ofcom
48000-48400	Video links	Yes	Ofcom

Annex 8

Glossary of abbreviations

3G	Third-generation mobile-phone standards and technology
ADR	Alternative dispute resolution
AIP	Administered Incentive Pricing
BEM	Block-edge mask
BGAN	Broadband Global Area Network
CEPT	European Conference of Postal and Telecommunications Administrations
CGC	Complementary ground component
dB	Decibel
dbW	Decibel watts
DDR	Digital Dividend Review
DIUS	Department for Innovation, Universities and Skills
DPSA	Digital preferred service area
DSO	Digital switchover
DTH	Direct-to-home
DTT	Digital terrestrial television
DVB-T	Digital Video Broadcast – Terrestrial
e.r.p.	Effective radiated power
EU	European Union
FRND	Fair, reasonable and non-discriminatory
GHz	Gigahertz
GSM	Global System for Mobile Communications
IM	Information memorandum
ITA	Invitation to Apply
ITS	Intelligent Transport Systems

JFMG	Joint Frequency Management Group
LTE	Long Term Evolution
m	Metre
MERLIN	Multi-Element, Radio Linked Interferometry Network
MHEG	Multimedia and Hypermedia Experts Group
MHz	Megahertz
MOD	Ministry of Defence
MPEG	Moving Picture Experts Group
MSS	Mobile satellite systems
mW	Milliwatt
PMSE	Programme-making and special events
QAM	Quadrature amplitude modulation
RA	Radiocommunications Agency
RSA	Recognised Spectrum Access
RSC	Radio Spectrum Committee
RSPG	Radio Spectrum Policy Group
SI	Statutory Instrument
SKA	Square Kilometre Array
STFC	Science and Technology Facilities Council
STU	Spectrum tariff unit
SUR	Spectrum usage right
UHF	Ultra-High Frequency
UMTS	Universal Mobile Telecommunications System
VHF	Very High Frequency
W	Watt
WRC-07	World Radiocommunication Conference 2007