OFFICE OF COMMUNICATIONS

Spectrum Framework Review for the Public Sector

Extending market mechanisms to improve how spectrum is managed and used

Statement

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Section 1

Summary

Introduction

1.1 This statement describes our conclusions, following a public consultation last year[1], on a new framework designed to enable public bodies to manage their radio spectrum holdings better. For the purposes of this document, "public sector spectrum holdings" include spectrum used by civil aviation and maritime operators, even though these are predominantly in the private sector.

1.2 We received over 50 responses and are grateful to all who commented[2]. There was broad support for the objective of improving public sector spectrum efficiency and for allowing public bodies to trade their spectrum holdings, although this support was qualified in some important respects, in particular in relation to national security, public safety and compliance with international obligations. We plan to consult later in the year on regulations to enable public bodies to trade spectrum and, in doing so, will take full account of the caveats that were expressed. We will proceed with the further consultation once the Government, which has stated that national security and public safety will remain paramount, has defined the detailed arrangements for public bodies to hold, manage and release spectrum.

1.3 The Ministry of Defence (MOD), which holds about a third of the spectrum below 15 GHz, has said that it will consult by May 2008 on its plans to release a significant proportion of its spectrum holdings.

New opportunities – sharper incentives

1.4 The theme of the new framework is the creation of opportunities for public bodies to release or share public sector spectrum holdings and the introduction of sharper, more effective incentives for them to take advantage of these. This has the potential to deliver substantial benefits for citizens and consumers. The reforms are central to a wider programme to implement the findings of the *Independent Review of Spectrum Holdings* (the 'Independent Audit') led by Professor Martin Cave. The Audit, the Government's response and other information can be found at www.spectrumaudit.org.uk.

Radio spectrum is a valuable and finite resource

1.5 Spectrum underpins 3% of UK GDP and its value to the economy has grown by 50% in real terms since 2002 to over £40bn a year[3]. Demand from commercial operators for certain frequencies, especially those suitable for mobile applications, already exceeds availability and this trend is forecast to continue into the medium term[4]. There is also demand from the public sector as described in the Government's

[1] *Spectrum Framework Review: the Public Sector* http://www.ofcom.org.uk/consult/condocs/sfrps/
[2] The responses may be found at http://www.ofcom.org.uk/consult/condocs/sfrps/responses/.
[3] *Economic Impact of the Use of Radio Spectrum in the UK* by Europe Economics for Ofcom http://www.ofcom.org.uk/research/radiocomms/reports/economic_spectrum_use/
[4] *Demand for Spectrum from Non-Government Services 2005-2025* at http://www.spectrumaudit.org.uk/010905.htm

Forward Look: A Strategy for Management of Major Public Sector Spectrum Holdings (the "*Forward Look*")[5].

1.6 Public sector spectrum holdings amount to nearly half of the total spectrum below 15 GHz. Although valuing these holdings is difficult, the Audit estimated that they could have a market value between £3bn and over £20bn[6]. Their more effective management could generate substantial benefits for citizens and consumers.

Market mechanisms are generally to be preferred ……

1.7 Our general approach to managing spectrum has been set out in our 2005 *Spectrum Framework Review*[7] and earlier documents on spectrum trading and liberalisation. One of our statutory duties is to secure optimal use of the radio spectrum to promote the interests of citizens and consumers. We consider that market mechanisms, such as spectrum trading, liberalisation, administered incentive pricing (AIP) and auctions, are in most cases more likely to achieve this than 'command and control' based on regulation and administrative decisions. We are progressively applying market mechanisms in the commercial sector.

… but do not yet apply very widely in the public sector

1.8 Public sector users such as the MOD and emergency services already pay charges for spectrum that are comparable to fees charged to commercial users. However, public sector spectrum holdings are not currently tradable; and aviation and maritime spectrum licence fees are not based on AIP.

We sought views on introducing spectrum trading for public bodies

1.9 The Independent Audit recommended, and the Government and Ofcom agreed, that market mechanisms should be extended more widely to public sector spectrum holdings in line with our policy in the commercial sector. The consultation proposed the introduction of tradable spectrum holdings for public bodies in the form of recognised spectrum access (RSA)[8] in order to promote spectrum efficiency and encourage spectrum release and sharing.

We will proceed with the new framework taking account of your comments

1.10 Spectrum trading by the public sector is expected to generate substantial benefits for citizens and consumers and we see no reason in principle why public bodies should not acquire and dispose of spectrum through the market. Having considered the responses to the consultation, we have concluded that we should proceed with our proposals. Accordingly, we will consult on regulations to introduce tradable RSA for public sector holdings taking full account of the comments that were made.

1.11 Respondents supported our proposal that the reforms should be introduced on a phased basis and broadly agreed with our initial assessment of the bands (406.1 - 430 MHz, 2.7 - 3.4 GHz and 3.4 - 3.6 GHz) that are likely to prove most attractive for alternative uses. These bands are likely to be given priority. The MOD is committed to releasing a "significant proportion" of its spectrum holdings beginning during 2008

[5] http://www.spectrumaudit.org.uk/pdf/Forward_Look_2007.pdf
[6] *Independent Audit of Spectrum Holdings final report*, page 2: http://www.spectrumaudit.org.uk/pdf/20051118%20Final%20Formatted%20v9.pdf
[7] http://www.ofcom.org.uk/consult/condocs/sfr/
[8] RSA provides a vehicle to enable Crown and certain other bodies to engage in spectrum trading.

and opportunities for spectrum release and sharing are expected to become clearer when it consults on its plans, which it expects to do in May 2008.

1.12 Complementary initiatives include:

- adoption of the presumption that public bodies will acquire spectrum through the market save in exceptional circumstances;
- consultation on applying AIP to selected frequency bands used for aeronautical and maritime applications;
- ongoing work to recommend safety criteria for radar to share spectrum and to assess the advantages and disadvantages of replanning certain radar bands before introducing trading;
- a review by the Civil Aviation Authority (CAA) and MOD, with Ofcom support, of aeronautical navigation aids including radar and landing systems;
- a review of arrangements for managing spectrum used by emergency and public safety services;
- proposals to make radio astronomy RSA tradable.

Section 2

Introduction

A new approach to managing public sector spectrum holdings

2.1 This statement presents our conclusions and future plans following a public consultation[9] in 2007 on a new framework for managing public sector (including civil aviation and maritime) spectrum holdings. The specific details of this framework, which is based on our market-based approach to radio spectrum[10], will depend on decisions by the Government and public bodies such as the CAA on the arrangements for managing their spectrum holdings. We will carry out a more detailed consultation when these decisions have been taken.

2.2 The objective of the new framework is to enhance the efficiency with which public sector spectrum holdings are used. Allowing public bodies to trade spectrum will provide important new opportunities and incentives for them to act in a way that secures the best possible use of the spectrum. This will complement and reinforce the effects of AIP.

2.3 The proposals are part of a programme to implement the findings of the *Independent Audit of Spectrum Holdings* led by Professor Martin Cave, which reviewed major spectrum holdings below 15 GHz. The report, which was published in December 2005, made a series of recommendations that were accepted by the Government and are being supported by Ofcom. Further information about the Independent Audit is given in the next section. Full details may be found at www.spectrumaudit.org.uk.

Explanation of some terms used in this statement

Meaning of 'public sector'

2.4 In this statement, unless the context otherwise requires, the term "public sector spectrum holdings" includes spectrum allocated to or managed by government or public sector bodies and used for defence, aviation (civil and military), shipping (civil and military), science services and public safety services. We have followed the terminology adopted by the Independent Audit in this respect even though civil aeronautical and maritime spectrum users are predominantly private sector.

2.5 Civil aeronautical and maritime users are regulated by the CAA and the Maritime and Coastguard Agency (MCA) respectively in relation to safety and other matters. The spectrum they use is mainly allocated to the MOD and CAA in the UK Frequency Allocation Table (UKFAT)[11]. The CAA plans aeronautical assignments. Maritime assignments are made by Ofcom.

Spectrum trading

2.6 Spectrum trading involves the transfer of rights and obligations relating to spectrum holdings in accordance with regulations made by Ofcom. This is a key element of the

[9] http://www.ofcom.org.uk/consult/condocs/sfrps/
[10] See Ofcom's *Spectrum Framework Review* at http://www.ofcom.org.uk/consult/condocs/sfr/.
[11] The latest version of the UKFAT may be found at http://www.ofcom.org.uk/radiocomms/isu/ukfat/ukfat07.pdf

new framework. There are various ways (or 'modes') in which spectrum can be traded. These are summarised in Annex 4. In brief, spectrum trading may:

- be time-limited, in which case the spectrum holding reverts to the transferor after a specified period of time (sometimes referred to as 'leasing' or 'sharing'), or permanent ('disposal');
- involve an entire spectrum holding ('total') or part of it ('partial') divided by frequency, geographical coverage or time;
- be 'outright' (the transferor does not retain any rights or obligations), or 'concurrent' (rights and obligations attach to both parties at the same time).

2.7 The term "spectrum trading" encompasses all of these possibilities. The modes of trading that are allowed are specified in trading regulations. Within their scope, the parties are free to agree the form that a particular transaction takes.

Spectrum holdings

2.8 "Spectrum holding" is used as a generic term to encompass wireless telegraphy (WT) licences, allocations to particular bodies as set out in the UKFAT and, under the new framework, by way of RSA. This statement focuses on the release or sharing of public sector spectrum holdings but similar processes could apply in reverse to allow public bodies to add to them.

Spectrum Usage Rights

2.9 There are references in this document to "Spectrum Usage Rights" (SURs). SURs are a way of specifying the technical terms and conditions of a WT licence or RSA in a way that is designed to be technology and application neutral[12].

The structure of this document

2.10 The rest of this document is arranged as follows.

- Section 3 – the spectrum management context
- Section 4 – promoting release and sharing of public sector spectrum holdings
- Section 5 – public sector RSA
- Section 6 – introducing public sector spectrum trading and RSA
- Section 7 – the trading and conversion processes
- Annex 1 - analysis of responses
- Annex 2 – list of respondents
- Annex 3 - impact assessment
- Annex 4 - spectrum trading modes
- Annex 5 – glossary

[12] http://www.ofcom.org.uk/consult/condocs/sur/ and http://www.ofcom.org.uk/consult/condocs/surfurtherinfo/

Section 3

The spectrum management context

3.1 This section explains the importance of radio spectrum, the significance of public sector spectrum holdings and Ofcom's approach to spectrum management. It also provides the background to the Independent Audit and the programme to implement its recommendations.

Radio spectrum is a key resource in short supply

3.2 Radio spectrum is a limited resource of considerable economic and social importance. Access to spectrum is key to innovation and competition in the fast-growing information and communications technology sector as well as to a wide range of other commercial and non-commercial applications, including defence, safety-of-life and emergency services, science and Amateur radio. Wireless technology is the key to meeting rising demand for communication and entertainment on the move. The importance of radio spectrum can be gauged from the fact that its use underpins an estimated 3% of UK GDP and generates benefits worth over £40bn a year, a figure that has grown by about 50% in real terms since 2002[13]. This is likely to be an underestimate as it does not take into account commercial aviation, public safety, defence or scientific use.

3.3 With few exceptions, the use of spectrum for one application imposes a cost on society as the same frequency cannot then be used for some other application at the same time and place. This cost is referred to as the 'opportunity cost'.

3.4 Different frequencies have different physical characteristics. Spectrum below 15 GHz is usually regarded as constituting the most useful and valuable part of the radio spectrum. Its physical characteristics mean that it can be used for a wide range of applications, including mobile at frequencies below about 4 GHz, while providing sufficient bandwidth for broadband services over large enough distances to make it commercially feasible to roll out national networks. Demand for spectrum at these frequencies is growing. It is critical for innovation and growth that they are used as efficiently as possible.

3.5 A study carried out for the Independent Audit by Analysys and Mason[14] concluded in 2005 that an additional 2.5 GHz of spectrum could be required below 15 GHz for new and existing technologies by 2025 and that:

> "spectrum shortages are likely to be a constraint which could prevent the future optimal deployment and growth of a wide variety of services".

Large amounts of spectrum are used by the public sector

3.6 Public sector spectrum holdings are used for a range of applications including defence and emergency service radio communications, aeronautical and maritime radar, meteorology and radio astronomy. These holdings account for nearly half of all radio spectrum and a similar proportion of frequencies below 15 GHz.

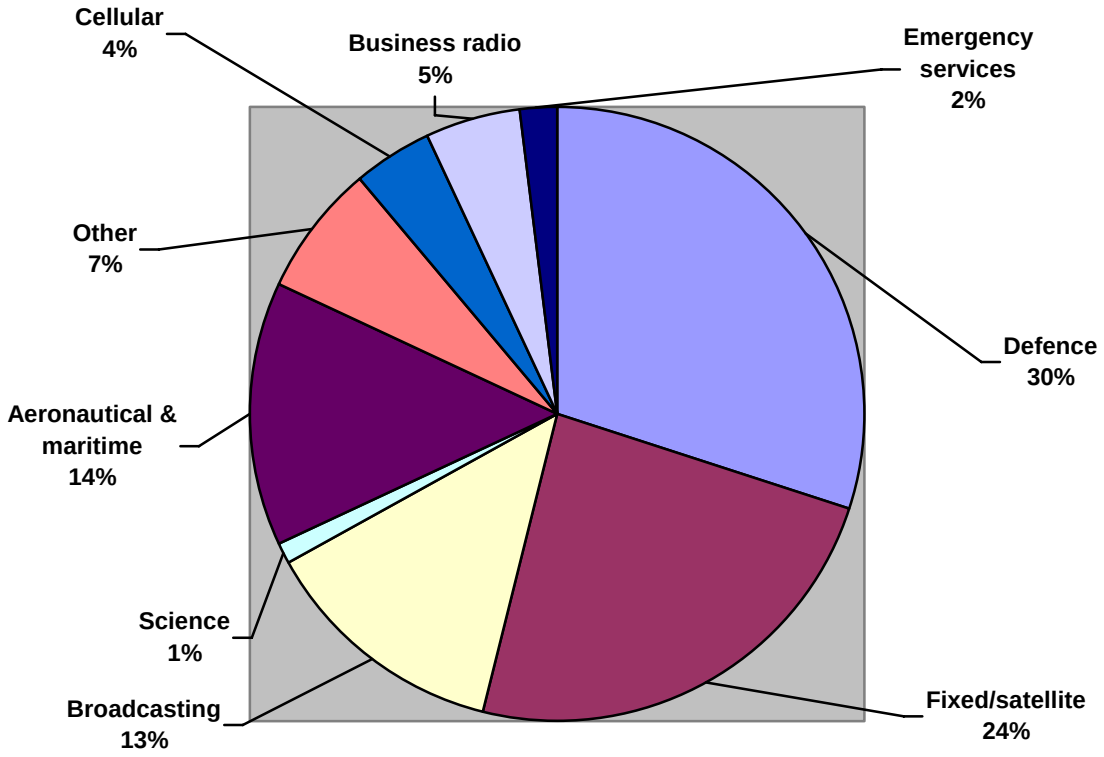
[13] http://www.ofcom.org.uk/research/radiocomms/reports/economic_spectrum_use/
[14] http://www.spectrumaudit.org.uk/pdf/spectrum_demand.pdf

3.7 The Independent Audit estimated in 2005 that the current market value of public sector spectrum holdings below 15 GHz ranged from £3bn to over £20bn, depending on the methodology used. This estimate is approximate. Valuing spectrum is difficult given the early stage of development of the spectrum market and is affected by a number of variables such as the characteristics of the frequencies in question, past market developments and past regulatory decisions. But even the lower end of the range is a very high figure.

3.8 Given the continued increasing demand for spectrum and the scale of public sector spectrum holdings, it is important to ensure that they are used as efficiently as possible. Failure to do so risks denying spectrum to other users and more generally using spectrum less than optimally. This would hold back innovation, competition and growth and be detrimental to citizens, consumers and businesses. At the same time, it is also vital to ensure that enhanced access to spectrum for businesses does not have unacceptable effects on national security or public safety.

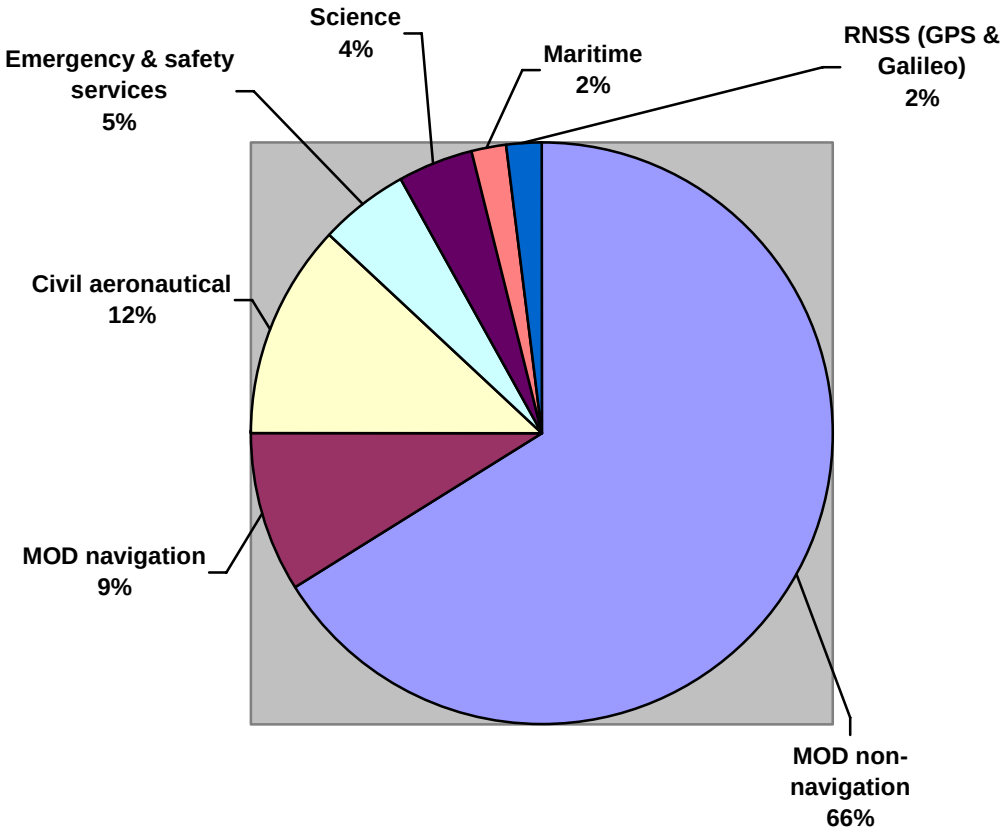
3.9 The charts below show the weighted[15] use of the radio spectrum and the make-up of public sector holdings below 15 GHz. The MOD is the single largest holder of radio spectrum but there are also sizeable allocations to the civil aeronautical and maritime sectors and emergency services.

Figure 1: Weighted use of the spectrum



[15] Figures are weighted so that a 1 MHz allocation at 100 MHz is given equal weight to a 10 MHz allocation at 1 GHz.

Figure 2: Composition of public sector spectrum holdings below 15 GHz



Source: Independent Audit of Spectrum Holdings

Our statutory functions and approach to managing spectrum

3.10 Ofcom manages the radio spectrum within a statutory framework created by the Communications Act 2003 (the 'Communications Act') and the Wireless Telegraphy Act 2006 (the 'WT Act'). These Acts[16], which give effect to EU requirements[17], set out our duties, functions and powers. In particular, we have a duty to secure optimal use of the radio spectrum having regard to the different needs and interests of all who may wish to use it and to have regard to the desirability of promoting its efficient management and use, economic and other benefits, innovation and competition.

3.11 Our duties require us to balance a range of considerations. We have a variety of regulatory tools and market mechanisms[18] at our disposal to manage the radio spectrum and use these to carry out our functions.

3.12 Under the WT Act, it is an offence to install or use radio equipment without authorisation from Ofcom[19]. This requirement is imposed because, without careful

[16] This is a condensed account, not a comprehensive description of the legislative framework.
[17] Including the Authorisation Directive 2002/20/EC and the Framework Directive 2002/21/EC
[18] An umbrella term used to encompass the application of market forces through spectrum pricing, auctions, liberalisation and trading.

planning and management, neighbouring transmitters that are not adequately separated geographically, by frequency or in time are likely to interfere with each other impairing the value of the airwaves as a communications medium and the benefits from its use. A primary aim of our spectrum management policy is to control the level of interference.

3.13 The WT Act does not bind the Crown so Crown bodies do not require authorisation to use spectrum. However, other arrangements are in place to plan and manage the spectrum they use and the Crown respects the rights of authorised non-Crown users. Private sector aviation and maritime spectrum users are subject to the WT Act authorisation framework.

3.14 Radio equipment may be authorised either by being individually licensed or by being exempted from the need for a licence by regulations made by Ofcom. We are required to exempt equipment that is unlikely to cause harmful interference[20].

3.15 Spectrum may be managed through the market (ie by market mechanisms described in the following paragraph) within the boundaries of licence terms and conditions designed to control interference or by regulation (referred to as 'command and control'). We consider that, in most cases, optimal use of the radio spectrum is better secured using market mechanisms than by 'command and control'. This is because market mechanisms enable choices about the services to be provided and technology to be made by those directly engaged in using the spectrum instead of being dictated by the regulator. The regulator is likely to have less complete and less up to date information about the value of alternative uses; and regulation is slower than markets to react to change. We have published a number of documents giving the rationale for our view, in particular our *Spectrum Framework Review*[21].

3.16 The market mechanisms that we are applying to allow spectrum to be managed by the market involve:

- **auctions** to award spectrum to those who can use it best;
- **AIP** to ensure that licence fees reflect the value of the spectrum and provide incentives to use it efficiently;
- **spectrum trading**[22] in accordance with regulations made by Ofcom[23] so that spectrum rights can be transferred to those who can use them better; and
- **spectrum liberalisation**[24], ie reducing restrictions on how spectrum is used while retaining necessary safeguards against harmful interference. Liberalisation enables spectrum to migrate to the most valuable use and is proceeding in stages from individual licence variation through making licences more generically flexible to selective introduction of fully flexible SURs[25].

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[19] This requirement originated in the Wireless Telegraphy Act 1904 and was continued by the Wireless Telegraphy Act 1949. The Wireless Telegraphy Act 2006 is a consolidation measure that combined several statutes, including the 1949 Act, without substantive change.
[20] Section 8(4) of the WT Act
[21] http://www.ofcom.org.uk/consult/condocs/sfr/
[22] http://www.ofcom.org.uk/consult/condocs/spec_trad/
[23] Section 30 of the WT Act
[24] http://www.ofcom.org.uk/consult/condocs/liberalisation/
[25] SURs are a way of expressing licence terms and conditions to be technology and application neutral. See http://www.ofcom.org.uk/consult/condocs/sur/

3.17 *Spectrum trading* provides a mechanism and incentive for those holding spectrum to transfer it to others who can create greater value from it and are therefore prepared to pay an amount that exceeds its worth to the incumbent. *Liberalisation*, by removing unnecessary restrictions on the way spectrum is used, enables users, who will generally have better information than the regulator, to select the applications and technologies that generate greatest value[26]. Together, trading and liberalisation facilitate and promote the socially optimal allocation of the spectrum resource. We agree with the Independent Audit that their application to public sector spectrum holdings will benefit citizens and consumers. The new framework will enable this to take place.

Spectrum management roles

3.18 Ofcom's activities in carrying out our spectrum management duties and functions include:

- making spectrum available for different applications or services;
- planning non-military spectrum usage to avoid excessive interference;
- assigning spectrum to individual users;
- granting and issuing licences and making exemption regulations to authorise use of spectrum under the WT Act;
- making trading regulations and consenting to proposed transactions;
- setting licence fees;
- representing the UK internationally, for example in relation to the UK's international coordination and harmonisation obligations;
- investigating interference and taking enforcement action against unauthorised use of spectrum.

3.19 This statement focuses on the first five of the above activities.

3.20 Spectrum allocations are set out in the UKFAT, which is drawn up and periodically revised by the UK Spectrum Strategy Committee (UKSSC), a Cabinet official committee that discusses matters relating to the use of the radio spectrum, including by government departments and other public sector bodies. The UKSSC is jointly chaired by the Department for Business, Enterprise & Regulatory Reform (BERR – formerly the Department of Trade and Industry) and MOD. Other organisations represented include Cabinet Office, HM Treasury, the Department for Culture, Media and Sport, the Department of Communities and Local Government (DCLG), the Department of Health (DoH), the Department for Transport (DfT), the Ministry of Justice, the Scottish Government, the Department of Trade, Industry and Investment Northern Ireland, the Meteorological Office, the MCA, Ofcom, the CAA and the National Policing Improvement Agency (NPIA).

[26] See http://www.ofcom.org.uk/consult/condocs/liberalisation/.

3.21 With one exception[27], Ofcom is the only body that has power to grant spectrum licences in the UK and the only body that can make exemption and trading regulations. However, in a more generic sense, various public sector bodies also have spectrum management roles to the extent that they make decisions about how public sector spectrum holdings are shared or use spectrum themselves as described below for the principal public sector uses.

Defence

3.22 The MOD uses spectrum extensively for military and security purposes but, as a Crown body, is not licensed by us. It plans the use of military spectrum within the allocations set out in the UKFAT and agrees with us the frequency bands in which it will operate and the terms on which commercial users may be licensed by us in spectrum allocated to military use. Sharing with non-military users currently takes place to a greater or lesser extent in most MOD holdings.

Civil aviation

3.23 The CAA is an independent regulator with responsibility for the aviation sector. It is not a Crown body and it does not use spectrum to carry out its statutory functions. The CAA regulates aviation in the UK and UK airspace, including economic and safety aspects, represents the UK internationally on aviation matters, plans assignments and issues aeronautical spectrum licences to ground-based users, such as airport operators, and UK-registered aircraft under a contract with Ofcom. Its responsibilities include developing, monitoring and enforcing national policy for the use and assignment of civil aeronautical radio frequencies[28].

Civil maritime

3.24 The MCA, an executive agency of the DfT, is responsible for coordinating sea and some inland search and rescue, enforcing safety rules and representing the UK internationally on maritime matters and operates a small number of vessels, coastal radar stations and aircraft. It operates some radio installations itself but does not require a licence; as an executive agency of the DfT, it is a Crown body. It does not plan assignments or issue WT licences.

Emergency and public safety services

3.25 Emergency and public safety services (E&PSS) comprise police, fire and ambulance services, the MCA, search and rescue operations and other Government enforcement agencies and public safety organisations (eg the Prison Service, HM Revenue and Customs, the Environment Agency). These have different sponsor departments within Government and are brought together within the Public Safety Spectrum Policy Group (PSSPG). The PSSPG is a standing interdepartmental committee reporting to the UKSSC. It comprises representatives from BERR, the NPIA, the Scottish Executive, the DCLG (for fire services), the Cabinet Office, the DoH, the MOD and Ofcom. E&PSS users that are not Crown bodies, such as the police, are licensed by us; those that are Crown bodies do not require WT licences.

[27] The Joint Frequency Management Group has been given powers under the Deregulation and Contracting Out Act 1994 to grant wireless telegraphy licences for programme-making and special events.

[28] The Civil Aviation Authority (Air Navigation) Directions 2001 (incorporating Variation Direction 2004) given under section 66(1) of the Transport Act 2000

The PSSPG advises the UKSSC and Ofcom on the current and future spectrum needs of E&PSS users but does not itself hold spectrum.

Radio astronomy

3.26 Radio astronomy is a passive (receive-only) service that is exempted from the requirement to be licensed as it does not cause harmful interference to other services[29]. RSA has been introduced for radio astronomy and Ofcom is currently reviewing RSA applications made by the Science and Technology Facilities Council (STFC)[30]. The applications that have been submitted confirm the STFC's decision to release spectrum in certain bands as detailed in table 3.2 below.

3.27 The roles of the bodies mentioned above are summarised in the following table.

Table 3.1: Roles in public sector spectrum holdings

Body	Whether body is allocated spectrum	Plans assignments	Advises on assignments	Issues licences	Grants licences	Uses spectrum
MOD	Yes	Yes	Yes	No	No	Yes
CAA	Yes	Yes – all assignment work on behalf of Ofcom including international coordination	Yes	Yes - under contract acting as Ofcom's agent	No	No – spectrum used on licensed basis by civil aviation operators (eg airports and airlines)
MCA	No	No	No	No	No	Yes
PSSPG	No	Advises Ofcom	Yes	No	No	No – spectrum used by emergency services, most of which are licensed
STFC	No	No	Yes	No	No	Yes

The Independent Audit

3.28 In his 2004 pre-Budget report, the then Chancellor of the Exchequer announced the Independent Audit of Spectrum Holdings by Professor Martin Cave to review what more needed to be done to ensure that all, including non-commercial, spectrum users, are focused on using spectrum as efficiently as possible. The Independent Audit was asked to concentrate on frequencies up to 15 GHz.

[29] The Wireless Telegraphy Apparatus (Receivers) (Exemption) Regulations 1989 (S.I. 1989/123) http://www.opsi.gov.uk/si/si1989/Uksi_19890123_en_1.htm

[30] Formerly the Particle Physics and Astronomy Research Council (PPARC).

The Independent Audit recommended application of market mechanisms to improve public sector spectrum efficiency

3.29 The Independent Audit published its report in December 2005 and made over 50 recommendations to improve spectrum efficiency in the public sector in order to help meet a sizable forecast shortage of spectrum below 15 GHz. A key theme was that public sector bodies should play a more active role in managing their spectrum holdings and engage directly with the market in order both to meet their spectrum needs and to exploit opportunities for sharing with commercial users. To this end, the report recommended that AIP should be extended to the aeronautical and maritime sectors, that public sector spectrum holdings should be made tradable and that public sector users should, save in exceptional cases, acquire spectrum through the market instead of having it assigned to them administratively by Ofcom.

3.30 Because Government departments do not hold licences for their use of spectrum, at present they cannot trade their holdings and have no mechanism to transfer spectrum directly to those who can use it to generate greater benefits. They can return spectrum to us but, as discussed in the next section, this provides less incentive and is a more cumbersome mechanism. Moreover, allocations to public sector users and high-level spectrum allocations to public sector bodies are set out in the UKFAT but, in many cases, are not specified or documented in detail and rest on informal sharing arrangements. These two factors – the non-availability of a trading mechanism and lack of precise definitions of spectrum holdings - constitute real barriers to making the best possible use of the spectrum.

3.31 The Independent Audit concluded that this is not a satisfactory basis for the future management of such a valuable resource and that introducing tradable RSA as discussed in this statement and related consultation would remove the obstacles identified in the preceding paragraph and benefit citizens and consumers.

The Government accepted the recommendations

3.32 The Government's response to the Independent Audit, which was prepared in consultation with us and published in March 2006, agreed with the Audit's analysis, accepted its recommendations and committed to an implementation plan. The Government reported on progress and future plans in December 2006 and in March 2007 in its *Forward Look*[31]. The October 2007 Pre-Budget Report stated that the MOD will by May 2008 publish plans to release a "significant proportion" of its holdings beginning in 2008.

Spectrum trading in the public sector will be beneficial

3.33 In particular, the Government stated its support for extending spectrum trading to the public sector. The principle underlying this approach is that spectrum is a valuable resource and should be treated in the same way as the other assets and resources, for example land, buildings or vehicles, that public bodies require and use. The public sector acquires these through the market at the market price, manages them so they are used as efficiently as possible and can dispose of them through the market if surplus to requirement. Although spectrum has certain distinctive characteristics, there is no reason in principle why it should not be acquired, managed and traded in the same way as other assets and good reason why it should be.

[31] http://www.spectrumaudit.org.uk/pdf/Forward_Look_2007.pdf

3.34 This is because a prospective user without access to spectrum who can generate more value than the incumbent from a spectrum holding will be willing to pay an amount that exceeds the value to the incumbent for access to that spectrum. If the spectrum holding is transferred, this will increase the value to society and both parties will gain. Spectrum trading provides both an incentive for beneficial transfers and a mechanism for them to take place. This applies as much in the public as in the private sector.

Evidence that market mechanisms work in the public sector

3.35 There is already evidence that AIP has stimulated releases of spectrum in the public sector. It is difficult to be definite about the cause of a particular release of spectrum since this is often the result of a complex combination of factors. However, there are indications that AIP was a factor in expediting each of the releases shown in the following table.

Table 3.2: Spectrum releases since 2004 that can be linked to AIP

Original user	Change	Bandwidth	Year
MOD	Release of 2290–2300 MHz	10 MHz	2004
MOD	Release of 8400–8500 MHz	100 MHz	2004
Commercial	Release of spectrum at 10 GHz	60 MHz	2004
Commercial	Release of spectrum at 410-415 / 420-425 MHz	10 MHz	2004
Radio astronomy	Release of spectrum at 37.75-38.25 MHz	0.5 MHz	2007
Radio astronomy	Remove constraints on active services at 150.05-152 MHz	2 MHz	2007
Radio astronomy	Remove constraints on active services at 80.5-82.5 MHz	2 MHz	2007
Radio astronomy	Release of spectrum at 10.60-10.68 GHz	80 MHz	2007
Radio astronomy	Remove constraints on active services at 31.5-31.8 GHz	300 MHz	2007
Police in Scotland	Release of non-contiguous spectrum in 450-462.5 MHz range	1 MHz	2007

3.36 This indicates that market incentives work in the public sector. The introduction of spectrum trading will reinforce this incentive effect and can be expected to lead to additional gains. This is because AIP encourages incumbents to return spectrum to Ofcom whereas trading enables businesses to acquire spectrum directly through the market. As discussed in paragraph 4.4 below, this can be expected to be superior as a mechanism for securing the best possible use of the spectrum.

Next steps

3.37 We strongly support the approach advocated by the Independent Audit and accepted by the Government. The responses to the consultation reinforce our commitment to providing the regulatory framework within which it can be implemented. The extension of spectrum trading to public sector spectrum holdings is central to this.

3.38 As discussed in the following sections of this statement, the responses to our consultation broadly support the objective of improving spectrum efficiency and access and the basic approach of making public sector spectrum holdings tradable on a liberalised basis. This support was qualified in some important respects, in particular in relation to national security, public safety and compliance with international obligations. However, we consider that the reforms will be beneficial and that the caveats that were expressed can be met through the way in which the reforms are implemented. In particular, the Government has made clear that national security and public safety will remain paramount. Accordingly, we plan to consult later in the year on regulations to enable public bodies to trade spectrum holdings. In so doing, we will take full account of the caveats that were expressed.

We expect to make regulations later this year but the exact timing will depend on Government decisions

3.39 Introducing the new framework will require us to make regulations, for example to specify the frequency bands in which trading and RSA will be introduced. The detailed architecture of the framework will depend on decisions to be taken by the Government departments, executive agencies and other public bodies concerned on various matters. These include the bands in which they intend to release or share spectrum, the identity of the public bodies to be responsible for holding and managing the spectrum and how decisions will be taken collectively where the interests of more than one department are involved. We are actively supporting this work and will consult on the draft regulations when it has progressed sufficiently.

3.40 Our current expectation is that we will be in a position to publish draft regulations by the summer and, subject to the outcome, to make them later in 2008. As required by section 122 of the WT Act, we will publish a Statutory Notice in advance of making the regulations, giving at least a month to comment.

Related initiatives

3.41 As reported in full in the *Forward Look* publication referenced in paragraph 3.32 above, the new framework constitutes one element of the overall implementation programme adopted by the Government following the Independent Audit. Other initiatives that have been completed or are being introduced include:

- adoption of the clear presumption that public bodies will acquire spectrum through the market save in exceptional circumstances. If the UKSSC agreed that an exception was justified, consideration would be given to formally directing Ofcom under section 5 of the Communications Act;
- introduction of RSA for radio astronomy and consultation on making this tradable;
- consultation on extending AIP to selected frequency bands used for aeronautical and maritime applications (see below), which is expected to be followed in the 2009/09 financial year by a more general review of AIP, which will affect the charges paid by Crown and other public sector bodies;

- adoption of targets for release of spectrum by departments as part of the outcome of the Comprehensive Spending Review (CSR);

- changes to the way in which Government departments, particularly the MOD, and other public sector bodies manage radio spectrum;

- establishment of the Radar Group (comprising the MOD, CAA and MCA) and the Public Spectrum Safety Test Group (PSSTG), which is undertaking a programme of work including technical trials at Oban and Loch Ewe in 2006 and 2007 that produced some useful data, to recommend safety criteria for radar to share spectrum[32];

- a detailed demand study by MOD of current and anticipated military spectrum requirements and publication by May 2008 of the MOD's plans to begin releasing to the market in 2008 a "significant proportion" of its holdings;

- a review by the CAA with the MOD and Ofcom of aeronautical navigation aids, including radar and landing systems, to ascertain the scope for improving spectrum efficiency by pursuing in the appropriate international fora the rationalisation of spectrum allocations;

- a review by the PSSPG of options for the future management of E&PSS spectrum holdings involving the use of market mechanisms to secure the best possible use of the spectrum and to maximise opportunities for band sharing while safeguarding the continuing operational effectiveness of E&PSS. The PSSPG has reported to the UKSSC recommending the establishment of a single body to manage E&PSS spectrum holdings and the Government has said that it will decide the future arrangements by the end of 2008.

Spectrum pricing in the aviation and maritime sectors

3.42 Since 1998, when AIP was introduced, it has been recognised that the public sector, as a major user of spectrum, should face the same incentives for spectrum efficiency as commercial spectrum users. Accordingly, much of the public sector, including the MOD and the emergency services, has, since that time, paid for spectrum on a comparable basis as the private sector. This does not at present apply in the civil aeronautical and maritime sectors, however.

3.43 The Independent Audit recommended that AIP should be extended to those sectors and we intend to consult on this shortly following pre-consultation discussion with stakeholders. Certain details of the design of the new framework could affect how AIP is applied and the proposals on which we consult will take account of these.

3.44 Several responses to this consultation anticipated the forthcoming consultation on AIP by commenting on licence fees for radio equipment, including radar, carried by ships. They argued that applying AIP would affect safety as leisure sailors might decide to dispense with VHF communications equipment rather than pay a higher fee and so be unable to communicate in an emergency. Ofcom would like to take this opportunity to respond to this concern.

3.45 From 1 December 2006, licensees have been able to apply for a free lifetime ship radio licence online through the Ofcom website at any time of day or night making the process quicker and easier. There is a small charge for postal applications. To date,

[32] See http://www.spectrumaudit.org.uk/bandsharing.htm

over 11,000 ship licences have been issued free online. We have no current plans to reintroduce charging or apply AIP to ships' radio (including ship-borne radar).

Summary

3.46 This section has set out the spectrum management context to the proposals and outlined the next steps in the implementation process. The next section discusses mechanisms for promoting spectrum release and sharing by the public sector.

Section 4

Promoting release and sharing of public sector spectrum holdings

4.1 The rest of this statement presents our conclusions on various aspects of the new framework and addresses comments and submissions received in response to the consultation. Annex 1 presents a more detailed analysis of the points raised. This section discusses how public bodies may release or share spectrum, a key aim of the reforms. Section 5 explains RSA. Section 6 focuses on how spectrum trading will operate.

4.2 We received over 50 responses to the consultation from a variety of commercial and non-commercial organisations and individuals and are grateful to all who commented. About half came from leisure sailors and focused on spectrum pricing rather than spectrum trading. About one-third of the remainder were from government departments or agencies or other public sector bodies and the rest from commercial or non-commercial private sector organisations or representative bodies. The responses, none of which were confidential although some respondents requested that their identities be withheld, may be found at http://www.ofcom.org.uk/consult/condocs/sfrps/responses/.

Mechanisms for releasing or sharing spectrum

4.3 At present, if a public body identifies an opportunity to release or share spectrum with commercial users (referred to in the Independent Audit as 'band sharing'), it returns spectrum to Ofcom to award or assign. The extension of spectrum trading will provide an alternative. Public bodies will be able to engage with the market to deal directly with those wishing to access their spectrum holdings in the same way as users in the commercial sector where trading has been introduced. The following paragraphs discuss whether direct engagement will be more effective in securing optimal use of the spectrum.

It is better if public bodies engage directly with the market instead of returning spectrum to Ofcom

4.4 Direct engagement with the market is likely to be more efficient and dynamically responsive than the indirect alternative. We see the following advantages of direct engagement.

- **More opportunities for others to access spectrum:** if a public body can benefit financially from trading, it has a greater incentive to release or share spectrum than if its gain is limited to a reduction in the AIP it pays. It might also be more willing to share or release the spectrum. It can control the terms and conditions to a greater extent than if Ofcom was running the award and so faces less uncertainty about the outcome.

- **Diversity in sources of spectrum:** availability of spectrum from public sector bodies will provide an additional source of supply and so increase choice. This is likely to promote the development of the spectrum market and enhance spectrum efficiency.

- **More effective incentives:** AIP might not fully reflect the true opportunity cost. We do not have complete information about market developments and AIP is reviewed only periodically so might not reflect the latest innovations in technology or services. There is therefore a significant possibility that, at any one time, AIP is not based on the highest value alternative use and is below the level necessary to provide sufficient incentive to make spectrum available for the best possible use.

- **Faster release of spectrum:** the process of returning spectrum to Ofcom to award is cumbersome and time-consuming – it can take 10 years or more in some cases. Ofcom believes that spectrum release and sharing can be substantially accelerated by trading and conversion of public sector spectrum holdings. The following diagrams illustrate this. They show that direct engagement is simpler and can be expected to be faster.

Figure 3: Indirect release (the status quo)

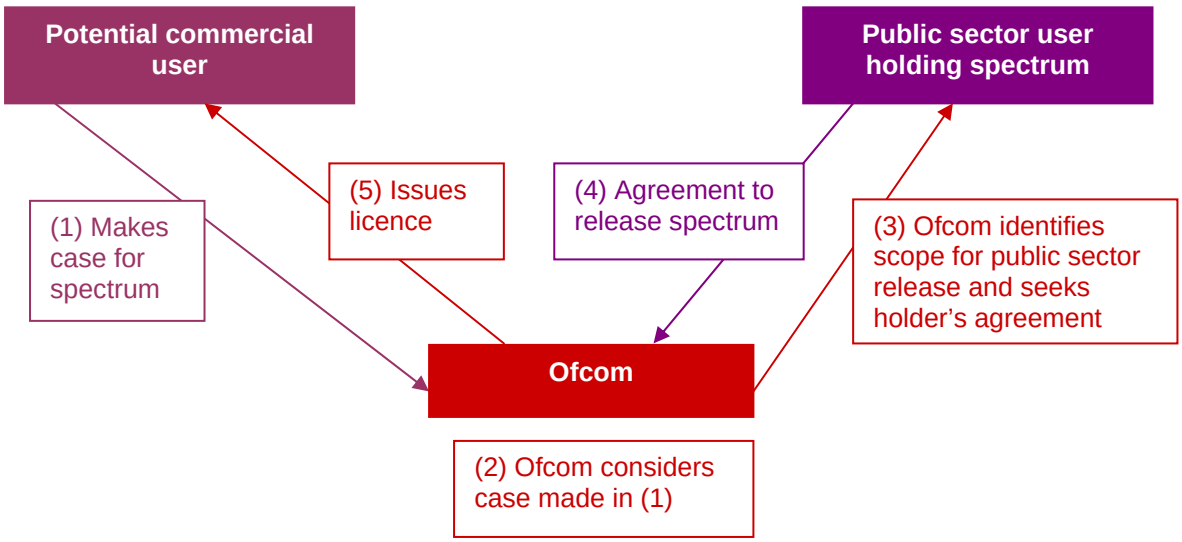
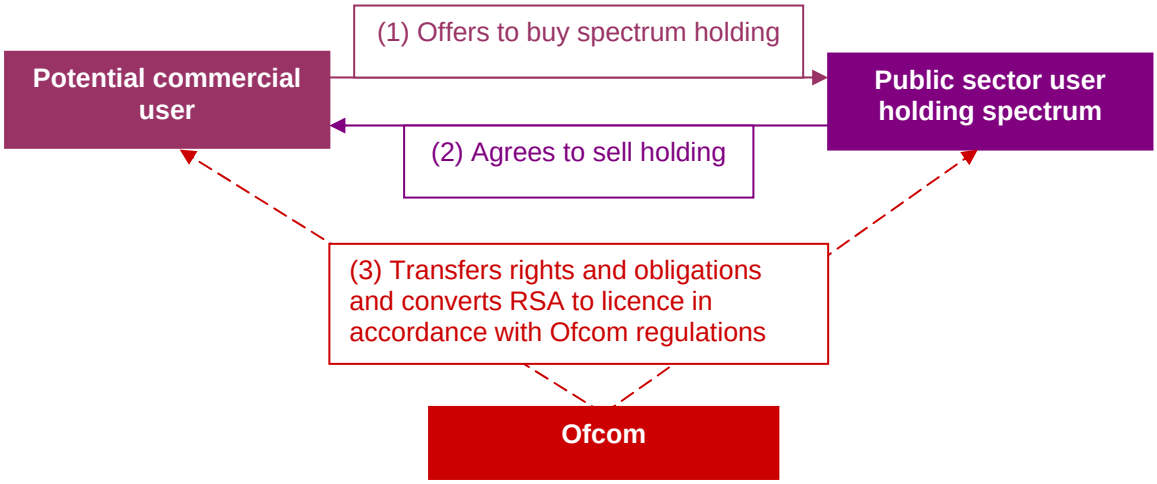


Figure 4: The proposed new framework



4.5 However, there might be circumstances in which indirect release to the market through Ofcom is more appropriate. It is therefore desirable that the framework should be sufficiently flexible to allow for both direct and indirect release of spectrum

holdings by public sector bodies even if, for the reasons in paragraph 4.4 above, direct engagement is generally preferred.

4.6 We work closely with public bodies on spectrum matters at present advising on how to secure optimal use of the radio spectrum for citizens and consumers and on international harmonisation and standardisation developments. We will continue to do this in relation to their plans to release or share spectrum holdings through the market.

Responses broadly supported our proposed approach but sought more detail

4.7 We asked whether you agree with our proposed overall approach to improving the management of public sector spectrum holdings and, in particular, with our conclusion that it is generally preferable for public sector bodies to interact directly with the market. We also asked what factors we should take into account in designing the new framework. This section discusses some of the main themes arising from the responses, which may be found at http://www.ofcom.org.uk/consult/condocs/sfrps/responses/. Annex 1 presents a more detailed analysis.

4.8 Our approach was supported by a range of respondents from both the commercial and public sectors. They welcomed the initiative to improve public sector spectrum efficiency and endorsed the principle that public sector bodies should interact with the market. As related above, several entered important qualifications about national security, public safety or international obligations. However, we consider that these can be met by the way in which the reforms are implemented by Ofcom and operated by the Government and public bodies concerned. These issues are discussed further in the following paragraphs.

4.9 Several respondents, while supporting the broad approach, felt that further work is necessary to specify the proposed regime in sufficient detail, for example on whether a single public sector body or several jointly should be responsible for interacting with the market. Public bodies committed to work with Ofcom to take this forward.

4.10 We accept that a number of important details remain to be specified. The consultation was about the high-level approach. As noted above, much of the outstanding detail will depend on the outcome of the consideration by public bodies of their arrangements for holding, managing, releasing and sharing spectrum.

The reforms should apply widely throughout the public sector

4.11 While there was support for the principle that public bodies should engage directly with the market, some respondents expressed doubts about whether it would be commercially worthwhile to exploit some public sector holdings, such as those used by emergency services, as they are too small or mainly available in rural areas.

4.12 It is difficult to predict where opportunities for spectrum release or sharing will arise. The course of future developments in electronic communications is uncertain, we lack the information needed to forecast outcomes with certainty and the sector is dynamic so predictions are likely to be overtaken. Against this background, we believe that the new framework should be rolled out as widely as possible over time although, as discussed below, we plan to phase initial implementation. This can be expected to maximise the benefits by allowing as many public bodies as possible to take full advantage of the opportunities to release or share spectrum. If there are concerns about the scale of particular spectrum holdings, one possibility might be for

the public bodies concerned to aggregate them under a third party band manager or intermediary as discussed in section 6 of this statement.

Factors for Ofcom to consider in operating the new framework

4.13 We asked about the factors we should take into account in operating the new framework. The following paragraphs set out issues given particular weight in responses and our conclusions on these. There is a more detailed analysis in Annex 1.

Public safety and health and national security will remain paramount

4.14 Many public sector spectrum holdings are used for purposes that are essential to national security, public safety or public health, in relation to which market failures are likely to arise. Several responses stressed the importance of ensuring that public safety services and safety-critical maritime and aviation applications, including navigation safety and life-saving, are not compromised and expressed concerns that release of public sector spectrum holdings could, in some circumstances, affect public safety or national security. Some argued that safety and security are not marketable commodities that should be traded or valued in financial terms.

4.15 We acknowledge the need to proceed with caution in introducing the proposed reforms. The Government stated in the response to the Audit that it will ensure that sufficient spectrum remains available for national security, defence and essential public services and that safety will remain paramount. The framework that is being developed is consistent with this commitment.

- Bodies such as the MOD, CAA, MCA, NPIA, DoH, DCLG and emergency services have specific responsibilities and expertise in relation to these matters. They will be in a position to make an informed judgment on whether or not to release or share their spectrum holdings, the amount and timing of releases and the technical conditions that need to be applied to safeguard essential operations, public safety or national security.

- Safety criteria are being developed to ensure through the imposition of appropriate technical conditions that sharing with other services does not cause harmful interference to existing radar operation. The CAA and MCA will carry out rigorous safety assessments of individual sharing proposals in bands allocated to civil aeronautical and maritime use.

4.16 The commitment to security and safety does not mean that the opportunity cost of spectrum should be disregarded in relation to security or safety critical applications. It is standard practice in the public sector to apply cost-benefit analysis techniques that take into account the cost of the resources needed to deliver particular policy objectives and balance these against the resulting social benefits, such as national security and public safety. This is done in order to secure the best use of those resources for society. There is no reason to treat spectrum differently from other resources in this respect.

The UK will continue to comply with international obligations

4.17 International obligations and interoperability requirements in relation to aviation and maritime allocations were seen as a major constraint on the extent of spectrum release or sharing. The UK is required to comply with its international obligations. Current trading regulations allow Ofcom to withhold consent to trades where

necessary to comply with an international obligation and the Secretary of State may direct Ofcom in the interests of complying. We currently envisage that these features will be carried over into the framework and will consult on this before making the trading regulations for the new framework.

4.18 Ofcom will work with the CAA and MCA in international bodies such as the ITU, International Maritime Organisation (IMO) and International Civil Aviation Organisation (ICAO) to review and, if appropriate in the light of safety and other relevant criteria, to relax constraints imposed by international obligations on sharing and release where this can be done without unacceptably affecting safety or international interoperability.

Ensuring effective competition

4.19 A key goal of the introduction of spectrum trading is that it should help to promote effective competition. The new framework will encourage public bodies to release their spectrum holdings to the market. This promises to create opportunities for new market entry or increased competition. However, as explained in our statement *Ensuring Effective Competition Following the Introduction of Spectrum Trading*[33], there is potential for individual spectrum trades to lead to a distortion of competition. A company or intermediary that obtained control of a large proportion of the spectrum necessary for a particular service might be able to behave in ways which could distort competition by, for example:

- preventing competitors in downstream markets from accessing it, thereby limiting competition in those markets;
- requiring customers to purchase additional products sold by the company when they purchase access to the spectrum. For example, if a company holding a large proportion of particular spectrum forced customers to purchase transmission equipment from them along with access to the spectrum, this could limit competition in related markets such as those for transmission equipment;
- charging excessive 'monopoly' prices (that is prices above the level necessary to ration demand to the total of the available spectrum). This is most likely to be possible where users cannot switch to alternative spectrum because their equipment works only on the frequencies controlled by the company or intermediary.

4.20 We have previously considered how to counter any risk that spectrum trading could lead to outcomes in which competition is distorted and concluded that general competition law should be sufficient for this purpose although we are keeping this conclusion under review. Our reasoning is set out in detail in our 2004 consultation and statement *Ensuring Effective Competition Following the Introduction of Spectrum Trading*[34]. This analysis should also hold in relation to trading of public sector spectrum holdings. Moreover, existing mechanisms for inter-departmental consultation and collective agreement will apply to departments' spectrum release programme and provide added assurance that decisions optimise economic and societal benefits, including those from competition. However, we will keep the situation under review.

[33] http://www.ofcom.org.uk/consult/condocs/sec/statement/statement.pdf
[34] http://www.ofcom.org.uk/consult/condocs/sec/statement/statement.pdf

Spectrum quality benchmarks

4.21 There was support for making public sector spectrum holdings available on a liberalised basis with as few restrictions as possible provided that legacy service performance was not degraded.

4.22 We recognise that widespread spectrum release might in certain circumstances affect the quality of service provided by public bodies. Moreover, changes of use can involve a risk of interference. However, decisions on whether to trade spectrum for an alternative use will be taken by the body holding the spectrum, which will be in the best position to judge the amount of spectrum that may be released or shared without an unacceptable effect on service standards and also the technical conditions that need to be imposed to avoid excessive interference to its own spectrum use. There are ways of defining technology and application neutral spectrum holdings that enable changes of use without harmful interference to existing authorised users. We have discussed these in our publications on spectrum liberalisation and SURs. In line with our general approach to liberalisation and change of use, we will continue to intervene as necessary to protect third parties from excessive interference where such interference is within our control. See paragraph 6.48 below for further detail.

Public bodies are best placed to judge how much spectrum they need

4.23 Concern was expressed that public bodies might dispose of excessive spectrum and it was suggested that we should exercise our spectrum management functions to ensure that they retain sufficient spectrum for their operational purposes. We are not persuaded that it would be appropriate for Ofcom to regulate in relation to these concerns by controlling proposed spectrum trades. It is for the public bodies themselves and the government departments to whom they are accountable to judge how much spectrum they need to discharge their responsibilities and their statutory duties and they are better placed than Ofcom to do so.

Other factors not discussed above

4.24 Other factors mentioned are listed in Annex 1. Several of these, such as coordination between public bodies or the implications for UK trade, are important but not matters for Ofcom. They extend beyond our remit to secure optimal use of the radio spectrum or are matters for the responsible government department or other public body. It is relevant to note in this connection that it is in general likely to be more efficient in economic terms to secure a socially valuable but non-commercial outcome by funding delivery of that outcome so that the provider of the service can acquire the inputs it needs through the market, rather than by providing subsidised inputs, such as free electricity, labour or spectrum. The Independent Audit concluded, and the Government and Ofcom agree, that, save in particular defined circumstances, public bodies should meet their spectrum needs through the market. Annex 1 provides a more detailed analysis of the factors suggested in the responses.

Summary

4.25 We have concluded that it would be beneficial to proceed with the new framework to allow public bodies to engage with the market through the creation of liberalised, tradable RSA and that the concerns that were raised can be effectively managed and mitigated. We take very seriously the points made in responses about national security, public safety and international obligations and will reflect these in the design of the new regime. We are also alert to the need to ensure effective competition.

4.26 The following section describes RSA and its potential application in the public sector by way of additional background.

Section 5

Public sector RSA

Introduction

5.1 This section explains the concept of RSA with reference to the public sector and the role of RSA in promoting more efficient use of public sector spectrum holdings.

5.2 Many spectrum users in the public sector are Crown bodies[35] and some operate 'passive' services, such as radio astronomy and some meteorology, that involve reception but not transmission. These users and services currently use spectrum without individual authorisation from Ofcom[36]. As a result, they have no formal recognition akin to that conferred by a licence. Their spectrum holdings cannot be traded and incentives to release them have been limited to a reduction in the amounts of AIP paid to Ofcom.

5.3 Formalising public sector spectrum holdings through grant of RSA offers several advantages as described in more detail below. In particular, it is a key enabler for trading public sector spectrum holdings that are not subject to WT Act licensing and so is central to extending market mechanisms in the public sector.

What is RSA?

5.4 RSA is a spectrum management instrument that was introduced by the Communications Act (and is now contained in the WT Act) to complement licensing and provide an alternative form of spectrum holding that can be made tradable.

Statutory provisions relating to RSA

5.5 Sections 18 to 26 of, and schedule 2 to, the WT Act contain the principal statutory provisions relating to RSA. The characteristics of RSA may be summarised as follows.

- RSA is available only where introduced by regulations made by Ofcom. The WT Act contains enabling powers and does not operate directly to introduce RSA.
- RSA may be granted in relation to both transmission and reception. RSA confers formal recognition but does not authorise spectrum use. It remains lawful for bodies that do not require a WT Act licence to use spectrum without applying for a grant of RSA in the frequency bands in which RSA has been introduced although they then forego the advantages.
- Ofcom may describe the restrictions and conditions in respect of which RSA is granted, including frequencies, times and places of reception and strength and type of signal, and the restrictions and conditions that apply, including, in particular, strength or type of signal, time of use and sharing of frequencies.

[35] There is no general legal definition of a Crown body but central government departments reporting to ministers such as the Home Office and Treasury are generally considered to be Crown bodies.
[36] Crown bodies do not require a licence. Passive services are inherently unlikely to cause harmful interference and so sections 8(4) and (5) of the WT Act require Ofcom to exempt them from licensing.

- Where Ofcom has granted RSA, it is under a duty in planning and managing the radio spectrum to take account of the use of spectrum in respect of which the grant has been made to the same extent as it would have regard to a licence issued in similar terms[37].

- RSA, may be made tradable and convertible into a licence, for example where it has been traded to a non-Crown body, in accordance with regulations made by Ofcom[38]. This means that RSA can provide a vehicle for extending spectrum trading beyond the categories of users that require licences.

- RSA may be granted by an auction process or on a 'first come – first served' basis and charged for on the basis of AIP[39]. Ofcom cannot require the Crown to pay AIP. However, the Secretary of State may make payments to Ofcom in respect of the use of spectrum by Crown bodies[40] in line with the Government's policy that the public sector will pay for use of spectrum on a comparable basis to the private sector.

RSA in the public sector

5.6 Radio equipment may be transmit-only, receive-only or capable of both transmission and reception. Transmission is sometimes referred to as 'active' and reception (without transmission) as 'passive'. The WT Act requires installation or use of radio equipment to be authorised by Ofcom. Authorisation may be either by an individual licence or by general exemption regulations.

5.7 The following table illustrates the availability of licences and RSA depending on whether use is active or passive and whether the user is a Crown body.

Table 5.1: Comparison of availability of licences and RSA

Use	Licences	RSA
Active use by **non-Crown** bodies eg non-military radar, emergency service radio communications	√ *(unless exempt from licensing)*	–
Active or **passive** use by **Crown** bodies eg military radar	–	√
Passive use by **non-Crown** public sector bodies eg radio astronomy	–	√

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The Independent Audit recommended introduction of RSA for the public sector

5.8 The Audit recommended that RSA be introduced for public sector spectrum use as a mechanism for promoting band sharing with the private sector. Recommendations 2.3 and 2.5, reproduced below with the Government's responses, are relevant.

[37] Section 20(2) of the WT Act
[38] Sections 30 and 27 of the WT Act
[39] Sections 27-30 of the WT Act
[40] Section 28 of the WT Act

Audit recommendation 2.3

"Public sector spectrum should be considered for its trading potential and in principle be made tradable on a comparable basis to commercially held spectrum. Decisions will need to be made on a case-by-case basis depending on the suitability for trading of each RSA agreed."

Response

"2.7 The Government supports spectrum trading by public bodies. Trading should facilitate competition and innovation in communications industries by allowing spectrum to be transferred to the highest value user. Both trading and sharing will allow access to the market for public sector bodies to realise gains that would otherwise not be achieved. Decisions over trading and sharing will be taken on a case-by-case basis by the departments and public bodies concerned.

2.8 There are both legal and practical issues that need to be considered before the implementation of trading by public bodies. For Crown bodies, RSA will be a critical enabler of trading, by clarifying and defining their legal rights. Ofcom will aim to clarify how RSA will operate for public sector spectrum holdings by the end of 2006, to inform the discussions on specific proposals for the sale or lease of spectrum in the Comprehensive Spending Review in 2007. Following this, Ofcom will work with the relevant Crown bodies to introduce RSA in key spectrum bands as required."

Audit recommendation 2.5

"Ofcom should work with key public sector spectrum users to introduce RSA, beginning with priority bands where there is most necessity for usage to be recognised. Charges should be attached, based on AIP. The presumption should be that RSA should be tradable and convertible unless there is a good case otherwise."

Response

"2.11 Ofcom is already well advanced in preparations to introduce RSA for radio astronomy following public consultation in 2005 and expects to consult by September 2006 on the necessary Regulations. Ofcom will also discuss with the relevant departments and bodies at an early date the extension of RSA to other public sector frequency bands with a view to identifying priority bands. These will then be taken forward with the aim of clarifying and resolving legal and technical aspects as quickly as possible. The Government and Ofcom agree in principle with the Audit on the advantages of making RSA tradable and convertible (to a conventional Wireless Telegraphy Act licence) in order to promote sharing with commercial users. Decisions on implementation will be taken following discussions of specific proposals for trading and sharing during the Comprehensive Spending Review in 2007. Following this, Ofcom will work with the relevant Crown bodies to introduce RSA in key spectrum bands as required.

> 2.12 The Government will work closely in co-operation with Ofcom to introduce RSA for Crown bodies in line with the principle that public sector users should continue to pay for spectrum on a comparable basis to the private sector, whether through licences, whole-band AIP or RSA. Ofcom will set charges for RSA in consultation with relevant departments. Disputes will be resolved by the UKSSC in accordance with the principle of comparability with private sector fees."

RSA will promote public sector spectrum efficiency

5.9 The Independent Audit and response set out in detail the potential benefits from the introduction of public sector RSA. These may be summarised as follows.

- RSA will sharpen incentives for public sector spectrum efficiency by enabling spectrum trading to be introduced for public sector spectrum users that do not have WT licences and so cannot readily engage in spectrum trading or leasing. Combined with the ability to convert RSA into WT licences, this will provide a mechanism and incentive for public sector bodies to share or release spectrum. The resulting availability through the market of additional spectrum for commercial use can be expected to provide new opportunities for innovation and growth to the benefit of consumers, businesses and the economy generally.

- Public sector users may benefit financially from generating income from spectrum trading or leasing while keeping direct control over the process.

- Public sector users will gain greater certainty about the precise terms and conditions on which they use spectrum as Ofcom will then have a statutory duty to take account of the use of spectrum in respect of which RSA has been granted. At present, this recognition rests on administrative arrangements and understandings that are not fully documented and of uncertain legal effect. The greater certainty will also benefit users in adjacent bands and those sharing bands with public sector users.

- Public sector spectrum holdings that are licensed or, in the case of radio astronomy, subject to grants of RSA are systematically recorded in Ofcom's spectrum database. Some Crown spectrum holdings are recorded in the UKFAT but there is no comprehensive and detailed list and information is not included in the Wireless Telegraphy Register (WT Register) published by Ofcom[41]. This constitutes an obstacle to efficient and timely spectrum sharing as information about opportunities cannot be advertised to potential sharers and the absence of detailed and accurate records of current frequency usage tends to delay the technical compatibility assessment of specific proposals. The introduction of RSA is expected to prompt more comprehensive recording of public sector spectrum holdings even though it is not a prerequisite for this to be done.

Summary

5.10 This section has explained the concept of RSA for public sector spectrum holdings and its advantages. The following section discusses some issues relating to the introduction of spectrum trading and RSA for public sector spectrum holdings.

[41] Under section 31 of the WT Act

Section 6

Introducing public sector spectrum trading and RSA

Introduction

6.1 This section discusses some issues relevant to the proposed introduction of spectrum trading and RSA for public sector spectrum holdings and, in particular selection of the frequency bands for, and geographical extent of, their application.

6.2 Spectrum trading has not yet been extended to public sector spectrum holdings. AIP does apply to most such holdings and provides an inducement for public bodies to reduce costs by releasing spectrum. However, as discussed in paragraph 4.4 above, this might not reflect the full opportunity cost. So allowing them to engage in spectrum trading will reinforce their incentives to improve spectrum efficiency and help make better use of the radio spectrum.

The introduction of public sector spectrum trading and RSA will be phased

6.3 Tradable RSA for public sector spectrum holdings could be introduced across all holdings in one step or rolled out progressively starting with frequency bands considered of higher priority.

6.4 Introducing tradable RSA in one step for all public sector holdings would maximise flexibility across a wide range of frequencies without the need for Ofcom to make more than one set of regulations. RSA would only be granted where public bodies applied for it and need be traded only where they wished to do so. It is arguable that one-step implementation could be advantageous in view of the rate and unpredictability of change in electronic communications. If RSA and trading were introduced gradually and opportunities became available in other frequency bands, it would take some time to extend them to allow advantage to be taken of the opportunities

6.5 On the other hand, the changes recommended by the Independent Audit and described in this statement mark a considerable shift in the way in which, and the extent to which, public sector bodies manage spectrum holdings; and the Independent Audit (recommendation 2.5) and response both concluded that work on RSA should commence in priority bands selected on the basis of the potential gains from, and practical difficulties associated with, enhanced sharing by commercial users. In view of the degree of innovation involved, Ofcom was minded in the consultation to agree with the Independent Audit and response that the changes should be phased in so that experience can be gained of how they operated in practice before they were extended more widely. This was consistent with Ofcom's general approach to introducing spectrum trading and liberalisation in the commercial sector.

6.6 We asked in the consultation whether the proposals should be phased in. Respondents strongly agreed that they should be. Reasons given included that phasing will enable Ofcom and public sector bodies concerned to focus resources on the frequency bands likely to generate most benefit and to gain experience of the practical operation of the new processes before applying them more widely. We agree and will proceed accordingly.

6.7 One respondent remarked that frequent small-scale changes should be avoided. We accept that making small adjustments too frequently can cause instability and uncertainty. On the other hand, making steps too large might be unmanageable or cause delay.

Selecting frequency bands for initial implementation

6.8 If implementation is to be phased, we need to select the frequency bands to be included in the initial step. It should be emphasised that decisions on release or sharing will be taken by the public bodies themselves. The regulations on which we will consult in due course will specify the frequency bands in which RSA will be introduced and made tradable. But it will be for the public bodies holding RSA to decide whether, when and how to take advantage of the opportunities presented by the regulations to engage with the market.

6.9 As discussed by the Independent Audit, it would seem sensible to prioritise on the basis of the expected gains and the practical complexity of implementation. These matters are discussed in following paragraphs. Relevant considerations include the needs of public sector users and the extent to which they can release spectrum, the demand for spectrum from commercial sharers and the technical characteristics of the frequency band in question.

The needs of public sector users

6.10 The reforms will allow decisions on spectrum release in bands in which trading is made possible to be taken by the public sector bodies concerned. They will need to judge the optimal mix of investment in more spectrum efficient equipment or use of alternative (non-wireless) technologies in the light of their operational requirements and the potential financial gains from spectrum release. The application of market mechanisms will provide them with the market signals and incentives to do this in an economically rational manner.

6.11 The Independent Audit included a band-by-band analysis that classified spectrum below 15 GHz as green, amber or red depending on the potential for release of spectrum or sharing. Green bands were those in which the Audit considered that action could be taken immediately or within a few years. Amber bands were those in which there was insufficient information to judge the prospects or those in which there were obstacles to action that could be overcome or that significant steps could be taken to address in the next 5 years. Red bands were considered to offer no scope for release or sharing or other action within the next 5 years.

6.12 The principal public sector user of spectrum is the MOD, which currently uses or manages about a third of the spectrum below 15 GHz. A survey for the MOD by consultants QinetiQ[42] has since identified that the Independent Audit's analysis was incomplete as it had been unable to take into account a significant proportion of the current military use of spectrum, information on which was classified. The priorities for release and sharing were adjusted in the Government's March 2007 *Forward Look*[43].

6.13 The MOD is making substantial progress in carrying out a detailed audit to identify which of its spectrum holdings can be released and when. Work has been completed on the 3.4 – 3.6 GHz, 406. 1 – 430 MHz and 2.7 – 3.4 GHz bands. The MOD has

[42] For security reasons, the report of this work is not being published.
[43] http://www.spectrumaudit.org.uk/pdf/Forward_Look_2007.pdf

said that, by the end of May 2008, work will have been completed on the 4.4 – 5.0 GHz, 7.9 – 8.4 GHz, 8.5 – 10.5 GHz and 13.25 – 14.0 GHz bands and that by the end of 2008, it will have completed a database of spectrum use in all the bands identified by the Independent Audit and published its plans for releasing spectrum to the market. The following table summarises the frequency bands that the MOD has prioritised so far and lists the other bands that are being considered. Some of these bands, eg 2.7 – 3.4 GHz and 960 - 1215 MHz, are shared with civil aeronautical or maritime use and access to them is managed jointly so the MOD could not unilaterally decide to release or share. The priority bands are subject to adjustment in the light of the results of the detailed audit currently under way.

Table 6.1: Priority and other bands identified by MOD with planned dates for completing detailed audit

Frequency range	< 1 GHz	1 – 4 GHz	4 – 10 GHz	>10 GHz
Detailed audit completed summer 2007		3.4–3.6 GHz		
Detailed audit completed end 2007	406.1–430 MHz	2.7–3.4 GHz		
Detailed audit planned to be completed by end of May 2008			4.4–5.0 GHz 7.9–8.4 GHz 8.5–10.5 GHz	13.25–14.0 GHz
Detailed audit planned to be completed by end of 2008	137–154 MHz 230–400 MHz 400.15–406.1 MHz 430-450 MHz 590 – 598 MHz 870-960 MHz	960-1215 MHz 1215-1350 MHz 1375-1400 MHz 1427-1452 MHz 1559-1626.5 MHz 2310-2450 MHz	4.2-4.4 GHz 5.0-5.85 GHz	15.4-17.7 GHz

6.14 Until the MOD completes its audit and publishes its plans, it will not be possible to say precisely which frequency bands might be released or shared with commercial operators. However, the Government has committed to releasing a “significant proportion” of the MOD’s spectrum holdings beginning during 2008.

6.15 In addition, the PSSPG has considered the scope for releasing spectrum below 470 MHz currently used by E&PSS. It has concluded that this spectrum needs to be retained for E&PSS purposes for the present pending further discussion with other government users.

6.16 One respondent felt that spectrum holdings used for aviation safety-of-life purposes should not be capable of being transferred to non-aviation applications. A similar point could be made in relation to maritime use. As discussed above, our general approach is to liberalise spectrum use and this is central to proposals to promote spectrum release and sharing by the public sector. The aim of the new framework is to allow public bodies to release and share spectrum on a flexible, liberalised basis. An excessively rigid approach would risk locking in sub-optimal use of spectrum. However, we will need to consider each licence class individually as we progressively apply the new framework.

Demand from commercial services

6.17 Potential gains from release or sharing can be expected to vary from band to band depending on demand from commercial operators. This will depend on the characteristics of the frequency in question and, in particular, its suitability for different services.

6.18 The Independent Audit commissioned a study of spectrum demand for non-government services for 2005-2025[44]. Historically, demand has been greatest for spectrum below 3 GHz as this presents the optimal combination of propagation characteristics (ie how well the radio waves travel over distance) and bandwidth (ie information-carrying capacity). Moreover, these frequencies can readily be used for mobile applications using current technology.

6.19 While spectrum between about 400 MHz and 3 GHz is often regarded as being particularly valuable and sought after, the consultants also expected demand for spectrum between 3 and 5 GHz to grow as technological advances raise the upper frequency limit for mobility and mobile wireless broadband services drive demand growth in this range. There is evidence of growing demand in Europe and globally for bands above 3 GHz with pressure for access for new wireless broadband technologies. Bands between 3 and 5 GHz are also emerging as a popular international choice for advanced mobile systems and were discussed at the World Radiocommunication Conference WRC-07 (agenda item 1.4 - see paragraph 6.34 below).

6.20 The report for the Audit concluded that:

- there may be high demand for additional spectrum below 1 GHz for broadcasting and cellular in less populated areas;
- there was an expectation of moderate demand for additional spectrum in the 1-3 GHz range to support commercial services such as cellular, broadband wireless access and possibly terrestrial broadcasting;
- demand for spectrum in the 3-6 GHz range was likely to increase if broadband wireless access services are highly successful commercially and new mobile cellular technologies are developed in this range;
- the highest absolute levels of demand were expected in the 6-15 GHz range for fixed and broadcast satellite services, point-to-point fixed links and broadband wireless access if this can compete effectively with wireline.

[44] http://www.spectrumaudit.org.uk/pdf/spectrum_demand.pdf

6.21 Based on this, our preliminary assessment, on which we sought views in the consultation, was that frequencies below about 5 GHz are likely to be particularly in demand for commercial exploitation and that there could also be shortages at those and higher frequencies.

6.22 Commercial respondents tended to agree with our initial assessment of the bands (406.1 - 430 MHz, 2.7 - 3.4 GHz and 3.4 - 3.6 GHz) that were likely to prove most attractive for alternative uses. However, it was pointed out that the 2.7 - 3.4 GHz band, while highly attractive for wireless broadband, is encumbered by safety-related and military (including NATO) use and the presence inland of ship-borne S-band radar along rivers and canals.

6.23 Respondents also referred to the radar band (1215 -1350 MHz), 5.4 GHz and 5.8 GHz but pointed out that these were constrained by public sector user requirements. These bands are being considered in the MOD's detailed audit (see table 6.1 above) and plans for their future release or sharing will depend on the outcome of that process.

Current use of the band

6.24 The extent to which a band is jointly allocated to different public sector users or already shared with commercial operators may also affect the attractiveness of a band to potential users. Almost all of the frequency bands allocated to the MOD are shared to a greater or lesser extent, including with users licensed by Ofcom (eg civil aviation and maritime, emergency services, FWA, Programme Making and Special Events (PMSE), Business Radio and Radio Amateurs). This has the potential to complicate additional spectrum release or sharing as it might be necessary to coordinate and negotiate with a larger number of neighbouring spectrum users in implementing a change of use. Table 6.2 below illustrates the current position for MOD spectrum holdings between 400 MHz and 5 GHz.

6.25 It will also affect the complexity of the process for release or sharing if more than one government department or public body has an interest in the management of a particular band. As shown by table 6.2, this is particularly relevant to the 'radar bands' between 2.7 and 3.1 GHz, which are shared by civil and military aviation and maritime radar. These are potentially extremely attractive for release or sharing because of their suitability for mobile broadband and a range of other commercial services. However, their current use for civil and military aviation and maritime applications complicates their management.

6.26 Discussions between the MOD, DfT, CAA and MCA on joint management of these bands have made useful progress but more needs to be done before tradable RSA is introduced there.

6.27 We recently published a statement on the Digital Dividend Review (470-862 MHz)[45], within which we set out our wider plans for future PMSE use of spectrum. The issue of how these proposals will apply to bands currently shared with the MOD will be addressed in more detail in a further consultation document planned for later this year.

[45] http://www.ofcom.org.uk/radiocomms/ddr/documents/statement/

Table 6.2: Examples of management and use in frequency bands allocated to the MOD

Frequency band	Primary allocation	Assignments by	Used by
400-430 MHz	MOD	MOD/Ofcom	MOD/emergency services/Business Radio
960-1215 MHz	MOD/CAA	CAA	MOD/civil aviation/RNSS
1215-1350 MHz	MOD/CAA	MOD/CAA/Ofcom	MOD/civil aviation/ amateur/ Earth exploration/ space research/RNSS
2310-2390 MHz	MOD	MOD/Ofcom	MOD/emergency services
2.7-2.9 GHz	MOD/CAA	MOD/CAA	MOD/civil aviation
2.9-3.1 GHz	MOD/CAA/Ofcom	MOD/CAA/Ofcom	MOD/civil aviation/civil maritime
3.1-3.4 GHz	MOD	MOD	MOD
3.4-3.6 GHz	MOD/Ofcom	MOD/Ofcom	MOD/emergency services/FWA/PMSE/Amateur
4.2-4.4 GHz	MOD/CAA	MOD/CAA	MOD/civil aviation

6.28 In the meanwhile, we expect to commence implementation in spectrum holdings allocated to the MOD. The MOD has the largest holdings of any public body and is most advanced of any department in preparing to engage with the market. In line with the Government's Forward Look, and the Pre-Budget report and the outcome of the CSR, this will begin in 2008. It will not be possible to be definite about the frequency bands that will first be released until the MOD finalises its plan for releasing spectrum to the market.

6.29 In addition, a band accommodating relatively few fixed transmitters will generally offer greater scope for sharing than one that is used intensively in terms of geographical location or frequency use. If a band is occupied and heavily used by incumbents, this will usually reduce the scope for sharing although it might be possible to re-plan the band so that it is used more efficiently and so to make more spectrum available for release or sharing. Coordinating with a mobile land-based or airborne service is more challenging because the location of transmitters is not known and changes as they move around.

Size of holding

6.30 Crown body spectrum holdings vary in scale from national bands allocated to government departments, such as the MOD, to manage under the UKFAT to assignments for individual point-to-point fixed links or mobile communications systems in spectrum that is managed by Ofcom. The latter arrangements are recorded in some cases in letters of assignment that are drafted in similar terms to our standard WT licences but cannot presently be traded.

6.31 We consider that it would in general be less advantageous and more cumbersome to introduce RSA for small disaggregated public sector spectrum holdings. It could be more efficient for small-scale holdings, such as individual fixed links, to be returned to Ofcom for reassignment if they become surplus to requirements. Accordingly, it is proposed to limit RSA initially to major public sector spectrum holdings that are

national or regional in scale and encompass a bandwidth large enough to accommodate a range of services.

International harmonisation

6.32 International harmonisation of spectrum use can take a number of forms. Harmonisation that is sufficiently flexible can enhance the benefits from spectrum by providing opportunities to exploit inter-operability, cross-border roaming and economies of scale in equipment manufacture. This is especially relevant to aviation and shipping because of their international nature.

6.33 Spectrum that is available internationally can be expected to offer attractive prospects for commercial operators. On the other hand, rigid harmonisation restrictions will limit the alternative uses that can be made of a band and can detract from its value. Changes to allow alternative uses in bands currently harmonised for aviation or maritime applications would require international agreement. Respondents agreed that international harmonisation is a material consideration that can increase the value of spectrum although the scope for release or sharing could be reduced in bands likely to be subject to future international restrictions.

6.34 It is relevant to note in this context that the frequency range 3.4 – 3.8 GHz is identified by the draft EU Recommendation on Wireless Access Policy for Electronic Communications Services (WAPECS) as a band in which Member States should grant licences on an application neutral basis and adopt a market-based approach, including allowing spectrum trading. The Radio Spectrum Committee is working on adopting in the near future a Decision, which would bind the UK, to designate the band on a non-exclusive basis for fixed, nomadic and mobile terrestrial electronic communications networks with a view to making it available for broadband wireless access, subject to technical limitations to avoid excessive interference to existing users.

6.35 Some of the frequency bands mentioned in this document and in which there are public sector spectrum holdings that might be released or shared were considered in the preparations for WRC-07 as candidate bands for future generations of mobile radio systems (previously described in the ITU as “IMT-Advanced”). The position the UK took at WRC-07 on this issue is described in an Ofcom statement published on 7 June 2007[46]. That position took into account the timescale for WRC-07 decisions, the current international climate and the nature of the relevant WRC agenda item. WRC-07 made a decision to identify in a number of new bands for IMT services, including 2.3-2.4 GHz and 3.4-3.6 GHz. The outcome of the WRC does not require countries to make spectrum available for IMT and does not preclude the use of the spectrum by other mobile applications or other radio services to which the bands are allocated. However it does send a strong signal to industry and is likely to encourage national administrations to review the future use of these bands. Irrespective of the outcome of WRC-07, there may be considerable scope for releasing spectrum at national level in some of the bands in question.

6.36 Once the programme of work to define safety criteria for sharing in radar bands has progressed to a stage at which firm conclusions can be drawn, we would intend to present these internationally with a view to exploring the possibility of making the international frequency allocations more flexible.

[46] http://www.ofcom.org.uk/consult/condocs/wrc07/statement/

We aim to make RSA and licences as flexible as possible

6.37 Grants of RSA may be subject to such terms and conditions as Ofcom thinks fit, including technical parameters such as frequencies, times and places of reception and strength and types of signal.

6.38 RSA for a receive-only service will contain different terms and conditions from RSA for a service involving transmission. The former will generally specify, in addition to other details, the maximum level of interference arising from other authorised users that is compatible with the use of the spectrum by the RSA holder. The latter will contain details of the transmission that is recognised (ie is legally required to be taken into consideration by Ofcom in the way in which it plans and manages the radio spectrum). As is the case for WT licences, the terms and conditions will need to take account of the existence of any incumbent licensees in the frequency band in question so that the recognised and the licensed transmissions can co-exist without unacceptably interfering with each other.

6.39 As outlined above, Ofcom is pursuing a policy of liberalisation by making spectrum use free of technology and usage constraints as far as possible so that licensees are able to decide themselves how best to use the spectrum. This is within limits that are necessary in order to avoid excessive interference and to ensure compliance with international obligations, for example the requirement not to allow active services in certain bands used for Earth observation and meteorology. This policy is being applied progressively for existing licensees in various frequency bands and wherever possible for new WT licences.

6.40 There is evidence that gains from trading combined with liberalisation are far greater than those from trading alone[47]. In the case of public sector holdings, an incoming commercial operator is highly likely to wish to use the spectrum for a different service than the public sector application, especially if the latter is highly specialised, eg radar.

6.41 Ofcom proposes to apply the same principles of liberalisation to RSA as to licences. This will simplify the process of converting RSA to licences that can accommodate different uses or technologies so it will be easier and faster for commercial sharers to gain access to spectrum for a range of alternative services.

6.42 Ofcom therefore proposes to make public sector RSA as technology and application neutral as possible and, where feasible, to cast RSA in the form of technology and application neutral SURs. We are carrying out further work on defining technical parameters on a band-by-band basis and will provide further details in due course.

There might be advantage in replanning some bands before releasing spectrum

6.43 In the case of public sector holdings in which there are already incumbent commercial sharers licensed by Ofcom, it will be necessary to consider whether to replan the band in advance of introducing trading in order to create a contiguous block of spectrum that may be released to the market or whether it would be better to

[47] *Study on conditions and options for introducing secondary trading of radio spectrum in the European Community*, by Analysys Consulting Ltd, DotEcon Ltd and Hogan & Hartson LLP at http://ec.europa.eu/information_society/policy/radio_spectrum/docs/ref_docs/secontrad_study/secontrad_final.pdf estimated that the benefits of spectrum trading and liberalisation combined are about nine times those from trading alone.

liberalise the licences and allow individual incumbents to trade independently. The Independent Audit concluded that replanning would be necessary in certain frequency bands, remarking on page 59 that:

> "in most aeronautical bands it will only be possible to make a major step forward in spectrum efficiency with coordinated action taken with the involvement of the sector regulator".

6.44 Ofcom's general approach is to avoid regulatory intervention unless justified and proportionate. This predisposes us in favour of allowing individual liberalised trading. However, radar raises particular spectrum management issues because of the high power of the transmitters, sensitivity of the receivers and the way in which bands are currently planned. Spectrum use has to be coordinated on an international basis and assignments are restricted to a specific use within a designated volume of coverage.

6.45 Bearing in mind these constraints, it is possible that there could be scope to increase spectrum efficiency in radar bands by a centrally coordinated process to reorganise assignments before the spectrum is made tradable. In the case of the 2.7 – 3.1 GHz radar bands, for example, this could involve migrating civil aviation radar from the 2.7 – 2.9 GHz band to share with maritime radar at 2.9 – 3.1 GHz, leaving some or all of the 2.7 – 2.9 GHz band unencumbered. Further work is necessary to establish whether this would be feasible. If it is, prior replanning might offer potential for spectrum efficiency advantages in some cases.

6.46 The consultation mentioned that Ofcom was discussing this issue with the MOD, CAA and MCA. Not many respondents commented specifically on it and views were mixed. The BandSharing Forum considered that individual trading would be more successful. On the other hand, Motorola considered that band reorganisation as a precursor to trading would maximise access.

6.47 We recognise that this is a complex issue and further study is needed on a band-by-band basis to assess the alternatives. Discussions with the MOD, CAA and MCA are continuing in the PSSTG to assess the advantages and disadvantages of the two routes to band sharing. This includes a comparison of the extent to which radar can safely share with other radar and with communications systems. The results will be published on the Audit website at www.spectrumaudit.org.uk and we will announce our conclusions in due course.

RSA will be designed to avoid excessive interference and Ofcom may intervene if interference arises

6.48 If RSA is introduced in bands in which there are incumbent users that are licensed by Ofcom, it will be necessary to define the RSA boundaries so that they and the RSA holder can coexist without causing or suffering unacceptable levels of interference. In line with our general approach to liberalisation, the boundary conditions of the RSA will be set so as to maintain the spectrum quality of incumbent users at a level that is no lower than their current spectrum quality benchmark (SQB)[48] although, for the reasons given on page 14 of our consultation on spectrum liberalisation[49], levels of interference cannot be absolutely guaranteed, for example because emission levels

[48] The SQB is the measure used by Ofcom in frequency bands in which SURs have not been introduced to define the standard of spectrum quality that licensees can expect to experience. It is based on Ofcom's technical frequency assignment criteria used by Ofcom in planning and granting assignments and represents the spectrum quality that users can reasonably expect to experience.
[49] http://www.ofcom.org.uk/consult/condocs/liberalisation2/liberalisation/spec_liberalisation.pdf

might differ from calculated values and depend on the number and distribution of licensed, licence-exempt and non-radio sources amongst other factors. RSA for passive services will be designed in accordance with this principle to reflect existing assignment policies and to avoid imposing any new constraints on other services.

6.49 If interference arises, our approach will be as set out in our consultation on liberalisation and statement on SURs[50]. Three cases may be distinguished.

- If a licensee is in breach of licence conditions, we will take the necessary and proportionate action in accordance with the relevant provisions of the WT Act. The process gives time for remedial action or representations to be made before a criminal prosecution is brought. An immediate interim close-down would be possible, especially if there was a threat to public safety or serious operational or economic problems were being caused to other users. Licence variation or revocation could be triggered following prosecution or repeated breaches.

- If the fault lies in the victim installation, we will not generally intervene as remedial action is the user's own responsibility. But we may, for a fee charged at commercial rates, advise the operator on remedial action.

- If the originator of the interference is operating within the licence terms and conditions and acted in good faith but interference nonetheless results from a discrepancy between the predicted and actual effects of the transmission, we will consider the facts of the case, representations by the parties and any other relevant considerations and decide what, if any, action to take. If the victim had previously agreed to the change that caused the interference, we would generally expect the parties to resolve the situation themselves in line with the terms of their agreement. If they cannot, or if the victim was not party to such an agreement, we will consider what action would be appropriate.

6.50 We are carrying out further technical work in conjunction with the MOD, CAA, MCA and other public bodies on how to specify the technical parameters of RSA. This will necessarily be on a band-by-band basis. We will publish further details in due course when the MOD's plans for spectrum release are clearer.

Public bodies could employ third parties to manage spectrum

6.51 Some respondents suggested that public sector bodies might need to employ an intermediary or band manager to act on their behalf if they did not possess the resource needed to manage their spectrum holdings. The PSSPG has indicated that it wishes to explore the possibility of employing a third party to manage the various E&PSS spectrum holdings currently used by a large number of different organisations and is discussing options with departments and other public bodies.

6.52 It will be for the public bodies concerned to decide whether there would be advantage in employing a third party intermediary or band manager. This could also be a way of aggregating smaller holdings to package them for release or sharing. We intend to make the new framework sufficiently flexible to allow public bodies to use the services of a third party if they wish to do so.

Procedure for granting RSA to public bodies

6.53 There are two cases to consider:

[50] http://www.ofcom.org.uk/consult/condocs/surfurtherinfo/statement/statement.pdf

i) where a public body has an existing spectrum holding without RSA and wishes to apply for RSA in respect of that holding; and

ii) where a public body wishes to add to its spectrum holdings by acquiring a spectrum holding for the first time.

Bodies with existing holdings

6.54 In line with the response to the Independent Audit, public sector bodies are generally expected to make any additions to their existing spectrum holdings through the market. It would be needlessly disruptive, however, to apply this principle to existing spectrum holdings and use.

6.55 Once regulations had been made to introduce RSA in a band, a public sector body with an existing holding that was not the subject of a WT licence could apply for a grant of RSA. We would normally expect to grant the RSA up to the limits of that holding. The terms and conditions of the grant would be discussed with the applicant and set so as not to exceed the boundaries of the current holding and so as to avoid imposing any additional constraints on licensees in neighbouring frequency bands or geographical areas. This is the approach we adopted for radio astronomy RSA.

6.56 We consider that granting RSA in this way in respect of existing holdings is justified because the grant simply formalises existing use of the spectrum and would be compatible with the spectrum quality benchmark of neighbouring assignments while avoiding imposing additional constraints on other services.

6.57 Ofcom would consider on a case-by-case basis whether to consult about the terms of the initial grants but would not normally expect this to be necessary as they would be designed to maintain the status quo.

Adding to spectrum holdings

6.58 The response to the Independent Audit stated that public sector bodies would be expected, if they wished to add to their spectrum holdings, to do so through spectrum trading save in exceptional circumstances. It is envisaged that the trading and conversion regimes would allow public sector bodies to acquire spectrum by the reverse of the process envisaged for release or sharing. Future spectrum awards by Ofcom may be designed to accommodate bids for and grants of RSA as well as WT licences.

Responses to the consultation on our proposed approach and our conclusion

6.59 We asked whether you agreed in general terms with our proposed approach to awarding licences and RSA to public bodies.

6.60 Respondents made a number of detailed comments on the proposed approach, the need for the process to be as quick as possible without unnecessary regulatory obstacles and the desirability of making RSA as technology and application neutral as possible. Some expressed support for the concept that public bodies should hold RSA and that this would aid operational effectiveness as well as enabling public bodies better to appreciate the value of the spectrum they hold. Others felt that insufficient detail of the processes had yet been provided to enable definite views to be expressed or sought clarity on specific issues including:

- the nature of the conversion process;

- whether conversion between RSA and licences would introduce additional constraints or obligations on the holder;
- spectrum quality;
- whether RSA might be varied after it has been granted. Some discretion to vary RSA for spectrum management reasons is thought to be necessary but too much uncertainty could detract from the value of the spectrum.

We recognise the need for further work to specify the framework in more detail

6.61 We accept that it will be necessary to specify the process in greater detail before it is introduced. The consultation was necessarily limited to broad principles as the detailed architecture of the new framework, including the operation of the trading and conversion processes, will depend on decisions by the Government on matters such as the identity of the entity that will apply for RSA and the mechanism for collective decision-making. For example, the issue raised by the MOD concerning which Secretary of State should hold RSA is a matter for the Government in the first instance as it will be for the departments concerned to decide which should apply for RSA.

6.62 As related in section 3 above, we are working closely with the departments and other bodies concerned on these matters.

Application of the proposals to the Channel Islands and Isle of Man

6.63 The consultation asked whether the new framework should be extended to the Channel Islands and Isle of Man.

6.64 The WT Act applies to the UK but has been extended with adaptations to the Channel Islands and the Isle of Man by Orders in Council[51]. It is envisaged that RSA, trading and conversion regulations will apply throughout the UK but it is also necessary to consider their application in the Channel Islands and the Isle of Man. The provisions of the WT Act relating to grant and conversion of RSA have been extended to Jersey, Guernsey and the Isle of Man; those on spectrum trading have been extended only to Guernsey although the present trading regulations do not apply there. This means that, at present, tradable RSA could in principle be introduced in Guernsey but not in Jersey or the Isle of Man.

6.65 The lack of opportunity for trading, which is an important part of the new framework, makes it doubtful whether early application of RSA to the Isle of Man and Jersey would be worthwhile. It is less clear whether it would be advantageous to introduce tradable RSA in Guernsey. Relevant considerations include the extent of any Crown use of spectrum on Guernsey and opportunities for sharing there.

What you said

6.66 Most respondents gave simple “yes” or “no” answers or were non-committal. Those giving more substantive replies considered that the new framework should extend to the Channel Islands and Isle of Man as radio waves do not stop at political boundaries and aviation and maritime applications need to be integrated because of their proximity to the UK. On the other hand, one respondent remarked that

[51] The Wireless Telegraphy (Jersey) Order 2006 (no.3324), the Wireless Telegraphy (Guernsey) Order 2006 (no.3325) and the Wireless Telegraphy (Isle of Man) Order 2007 (no.278)

extension was desirable but not necessary and that the reforms could proceed in the UK before being extended to the islands. One respondent made the point that care should be taken that interference does not hamper search and rescue operations. Another stated that the French air navigation service might have a view as the Channel Islands are within a French flight information region.

We will discuss further with the administrations involved

6.67 We have not reached a final decision on this matter yet and will discuss it further with the Isle of Man and Channel Islands administrations and with the French authorities if necessary. It would be necessary for an Order in Council to be made to extend spectrum trading to Jersey and the Isle of Man if the administrations there wished the framework to apply.

Summary

6.68 This section has discussed the process for granting RSA in public sector spectrum holdings. We agree with many of the comments made, including the need for phasing, that further work is needed to define detail and that spectrum holdings should be specified in a flexible way. These matters will be clarified when decisions have been taken by the government departments and other public bodies concerned on various aspects of the new arrangements.

6.69 The following section outlines the process for releasing and sharing public sector spectrum holdings through trading and conversion.

Section 7

The trading and conversion processes

Introduction

7.1 This section discusses the release and sharing of public sector spectrum holdings and the processes for spectrum trading and conversion between public sector RSA and licences.

7.2 Sharing with commercial users will involve one or two stages:

i) transfer of rights and obligations; and

ii) if the original holding is in the form of RSA, conversion of this into a licence (or vice versa in the case of acquisition to add to the holding).

7.3 The details of the procedures will depend on the arrangements that public sector bodies adopt for managing their spectrum holdings, especially those shared by one or more public bodies. These have not yet been specified in sufficient detail to enable us to describe exactly how they will operate. The following paragraphs therefore provide an indicative outline only.

The process for transferring rights and obligations

7.4 The trading regulations and processes that are already in place[52] for WT Act licences provide a reasonable starting point for trading regulations for public sector spectrum holdings. Based on existing trading regulations, they would have the following features.

- They would specify the frequency bands and class of RSA and licence for which trading is being introduced.
- There would be flexibility to undertake the full range of modes of trading - total or partial and outright or concurrent - as explained in more detail in annex 4.
- There would be flexibility to partition spectrum holdings by frequency or geographical coverage but it might be necessary for practical reasons to impose some minimal restrictions, for example the minimum quantum of bandwidth or geographical coverage that may be traded.
- Transfers would not be allowed:
    - without the consent of the current holder or holders;
    - if sums are owing to Ofcom in respect of the holding;
    - if Ofcom has given notice of variation or revocation;
    - without Ofcom's consent, which would normally be expected to be forthcoming;

[52] The Wireless Telegraphy (Spectrum Trading) Regulations 2004 No.3154 as amended

  - the regulations would set out the circumstances in which Ofcom would be entitled to withhold consent. In the existing trading regulations, these are limited to cases in which there is a breach of licence or RSA terms and conditions by the holder or the transferee or transferor is considered to be unable to comply with the terms and conditions of the grant or if it is necessary to withhold consent on grounds of national security, compliance with an international obligation or compliance with a direction from the Secretary of State.

- Transactions will involve the issue of a revised RSA and licence to the transferor, transfer of the traded holding to the transferee and conversion of the transferred RSA into a licence (assuming that the transferee is not a Crown body).

- We do not intend to charge for transfers or conversion of public sector spectrum holdings although we will keep that policy under review,

7.5 The current trading process involves the surrender of the original licence and the making of fresh grants that reflect the terms and outcome of the transaction. Extended to public sector holdings, this would operate as follows.

- The transferor and transferee agree the terms of the transfer, which is then notified to us to obtain our consent. We then issue amended licences or RSA to the parties in accordance with the terms of the transfer.

- We may withhold consent only in the circumstances set out in the trading regulations. These are discussed further below.

- The regulations specify the types of transfer that are permitted. Transfers may be total or partial and outright or concurrent. Annex 4 provides further details about these different types (or 'modes') of trading.

- Time-limited transfers (sometimes referred to as 'leasing') are possible and involve separate reversal of the original transaction at a time agreed by the parties.

- We publish certain information about licences in the WT Register and limited details about transfers in the Transfer Notification Register (TNR). Both registers are available on our website.

- To facilitate release to or sharing with commercial bodies, the transaction may also involve conversion of the RSA to a licence in accordance with conversion regulations.

7.6 Further details of the current trading process may be found through our spectrum licensing portal[53].

Conversion and change of use

7.7 Conversion of RSA into a licence and vice versa is a new procedure that has no parallel in current trading regulations or processes. The details of the process will be set out in the draft regulations on which we will be consulting later this year.

[53] http://www.ofcom.org.uk/radiocomms/isu/ukpfa/about

7.8 Overall, we agree with respondents who said that the processes should be as straightforward as possible and will aim to minimise regulatory burden, commercial uncertainty and excessive delay. We intend to use the present trading regulations as the basis for the procedure for public sector spectrum holdings.

Grounds to refuse consent to trades of public sector spectrum holdings

7.9 We asked in the consultation whether the grounds to refuse consent for transfers of public sector spectrum holdings should mirror those in the current trading regulations or whether additional grounds are necessary, for example on grounds of a risk to public safety.

7.10 The current trading regulations allow Ofcom to withhold consent to a proposed transaction in limited circumstances, for example that the transferor has not paid the licence fee, that the assignment is subject to re-farming or that it is requisite or expedient to withhold consent in the interests of national security. Our policy, which is in line with our regulatory principles and duty[54] to avoid imposing unnecessary regulatory burdens, is to keep the grounds on which we may block a trade to the minimum. This is in order to provide commercial certainty and to avoid deterring or delaying beneficial transactions.

7.11 Many respondents from both public and commercial sectors mentioned public safety and the operational effectiveness of the emergency services although one respondent disagreed that additional grounds were required. It was pointed out that current trading regulations enable us to refuse consent on national security grounds and adding public safety would be a logical extension. Other grounds that were mentioned included:

- interference to existing users;
- impact on property or cargo;
- damage to the environment;
- whether public bodies have sufficient spectrum.

7.12 In considering these, a key issue is whether there is sufficient need or justification in the particular circumstances of public sector spectrum holdings to add to the regulatory burden by introducing additional grounds for refusing consent. We have to consider this in the context of our duty to avoid unnecessary regulatory burdens and our aim of minimising commercial uncertainty and delay.

Public safety

7.13 In some circumstances, release or sharing of spectrum holdings could affect air or maritime safety or the operational effectiveness of an emergency service. An important consideration is whether the responsible regulator, government department or agency has sufficient powers to intervene if necessary to maintain safety.

7.14 As discussed in the preceding section, Ofcom would investigate complaints of interference to safety-of-life services as at present. However, having carefully considered the responses, we are not at present persuaded of the justification or

[54] http://www.ofcom.org.uk/about/sdrp/ and section 6 of the Communications Act 2003

need to include in trading regulations a public safety ground for withholding consent to proposed transfers of public sector spectrum holdings.

7.15 Ofcom is not expert in the public safety aspects of services such as air or maritime navigation. Provided that the initial grants of the licences and RSA in question impose appropriate technical conditions to avoid harmful interference, regulation to secure public safety is therefore more appropriately undertaken where necessary by those regulators with direct responsibility for safety, such as the CAA and MCA. The purpose of the spectrum trading regulations is to provide a framework consistent with Ofcom's spectrum management responsibilities and duties for the supervision of transfers of spectrum holdings. They are not a particularly suitable or effective, tool for maintaining safety as they cannot positively ensure that safety-critical radio systems are provided. At most, they could provide a negative safeguard by preventing spectrum from being transferred.

7.16 Moreover, there is a significant distinction between national security and public safety that justifies different treatment under the trading regulations. In the case of national security, there is a potential risk deriving from the identity of the transferee. This might well not be apparent to the transferor so it might be necessary for us to intervene. In the case of public safety, on the other hand, the potential risk arises from the effect on the transferor's own use of spectrum. The transferor and the responsible regulator can be expected to be better placed than Ofcom to assess this. However, we will discuss this further with the DfT, CAA and MCA before reaching a final conclusion.

Other grounds

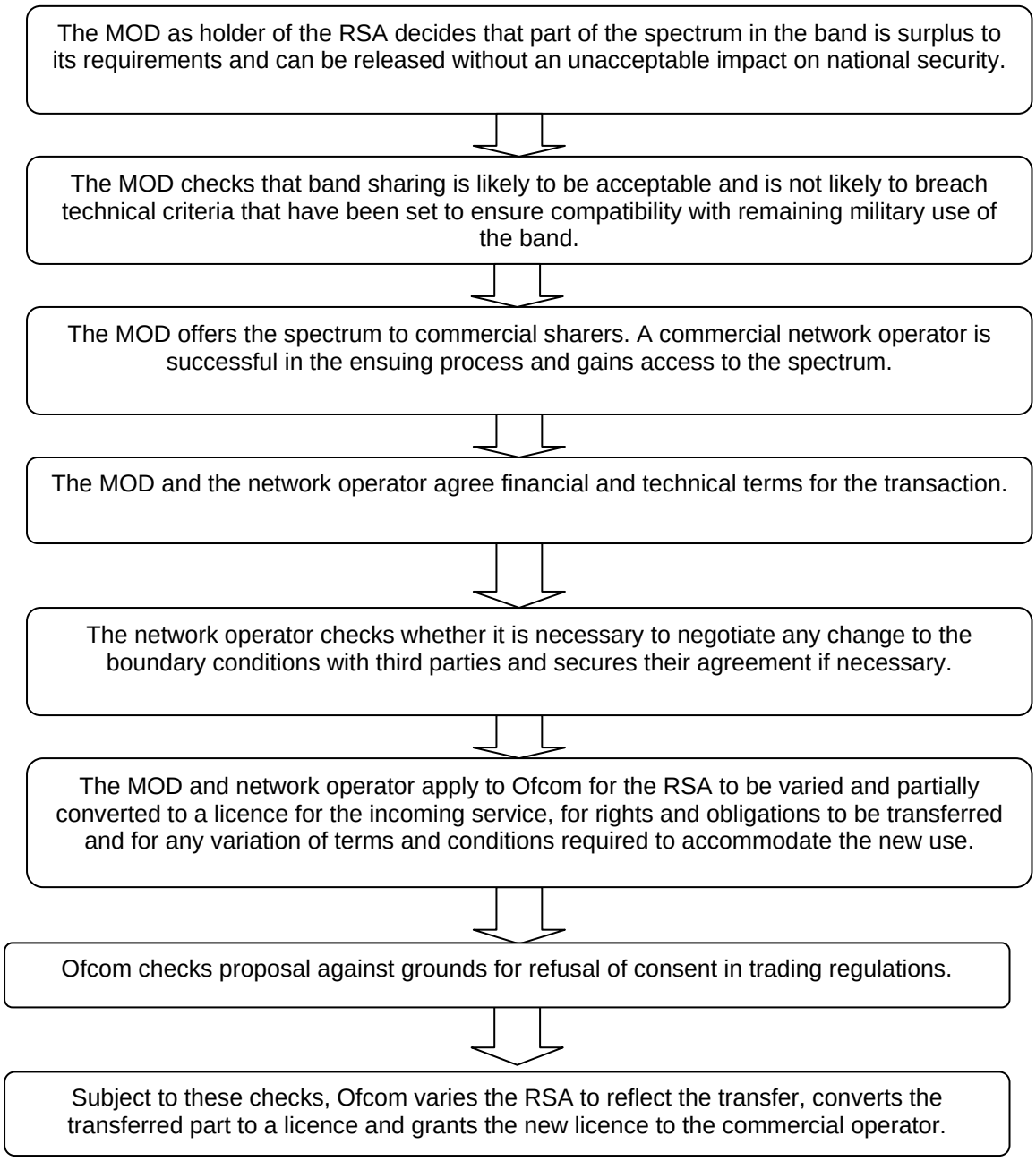
7.17 Neither are we persuaded that it would be necessary or proportionate to add other grounds that were suggested such as interference or environmental impact. This is for various reasons. In some cases, the risk is too remote or indirect from the transfer itself. In others, it is insufficiently directly related to Ofcom's spectrum management functions and responsibilities or can be better controlled in other ways or by other regulators. For example, interference to existing users, which arises from change of use rather than change of user, will be controlled through the terms and conditions in licences and RSA; and the environment is more appropriately and effectively protected by environmental legislation. Annex 1 provides a more detailed analysis.

An illustrative example

7.18 The flowchart at figure 5 below outlines how the spectrum release or sharing process might work in a hypothetical example in a band that is allocated exclusively to military radar. It is assumed in the example that the public sector spectrum holding is in the form of technology and application neutral RSA held by the MOD so there is no need for the licence granted to the transferee to be varied to permit a change of use although it might be necessary to negotiate with third parties if their spectrum quality would be reduced below their SQBs.

7.19 This example is purely illustrative in order to clarify the principle. The procedures cannot yet be specified in detail as much will depend on the spectrum management arrangements entered into by the MOD and other public sector bodies. The process is likely to be more complex for spectrum holdings in which other public bodies share an interest.

Figure 5: Schematic spectrum release and sharing process



Providing information to the market

7.20 Publication of information about spectrum holdings and transactions is an important facilitator of trading and sharing as it enhances transparency and aids the market by informing potential purchasers or sharers of the opportunities that are available and transactions that have taken place. We currently publish information about grants of licences and RSA in the WT Register and about transfers of licences in the TNR. Both registers are published on our website.

7.21 As part of the new framework, we will put in place arrangements to publish information about RSA and transfers of RSA. In so doing, we will take account of the

fact that there might be a need for certain sensitive information to be withheld for security reasons. We will consult on this with other details of the regulations in due course.

Annex 1

Analysis of responses

Introduction

A1.1 This annex presents a detailed analysis of the main points made in the responses together with Ofcom's observations. The responses themselves may be found on our website at http://www.ofcom.org.uk/consult/condocs/sfrps/responses/.

Table A1.1: Main points made by respondents to the consultation with Ofcom's observations

Issue raised in response to the consultation	Our observation or conclusion
Question 1: do you agree with Ofcom's proposed approach and, in particular, that it will generally be preferable for public bodies to interact directly with the market?	
More detail is needed about the framework design.	We agree that it will be necessary to provide further detail as explained in the main body of this statement.
Public bodies' spectrum trading should be monitored to ensure that there is no impact on safety-critical applications.	It will be for the public bodies concerned in the first instance to judge how much spectrum they need to provide essential services. For the reasons given in section 7 of this statement, we are not currently persuaded of the need to have a public safety ground to withhold consent to a proposed transfer but will discuss this further with the relevant sector regulators.
Safeguards should be imposed to require public bodies to retain sufficient spectrum No existing search and rescue frequencies or channels should be removed until a comparable provision is available.	The fundamental approach of the new framework, is that public bodies themselves should decide whether they can release or share spectrum while continuing to provide essential services. This includes search and rescue services.
Public bodies will not be able to engage with the market as they lack resource and expertise.	There is no reason to believe that public bodies are inherently incapable of engaging with the market for spectrum as for their other inputs or that they will not be able to acquire additional expertise, possibly from external advisers. Decisions on their financial and other resources are matters for the Government.
The scope of E&PSS to interact with the market is limited. Their holdings are relatively small, they are secondary users in most cases, the need to maintain operational effectiveness will constrain sharing, greatest scope to share will be in rural areas where demand from commercial services is likely to be low.	For the reasons given in section 4, we conclude that the new framework should apply generally, including to E&PSS, which will enable each public body to decide whether and how to take advantage of the opportunities.
Implementation should be moderated to take account of potential impact on international trade.	The promotion of trade into and out of the UK is not a matter for which we are directly responsible and is more a matter for the Government. Using spectrum more efficiently should benefit consumers.
Bands should be reorganised before being released. But another respondent considered this to be unnecessary.	Each case needs to be considered on its merits. Further study is needed and it is not possible to generalise. Prior replanning might increase spectrum efficiency in some cases.

Issue raised in response to the consultation	Our observation or conclusion
Air traffic control is a state responsibility and the UK should respect its international obligations. Air safety depends on interoperability. Ofcom should retain radio regulatory responsibility.	The Government has made clear that safety will remain paramount. The framework will be consistent with this and with continued compliance with the UK's international obligations. We will continue to exercise our responsibilities under the WT Act in line with the new framework.
Market mechanisms do not always maximise benefits. Spectrum might transfer from budget-constrained public bodies to affluent commercial organisations. The most profitable uses are not always socially optimal.	We have consistently explained the reasons why we consider that market mechanisms will in general secure optimal use of spectrum. For reasons set out in this statement, see no reason why this principle should not apply in the public sector. It is for the Government to ensure that public bodies have the resource they need to continue to provide essential services and, where necessary, to acquire additional spectrum through the market.
Safety and security are not marketable commodities and market valuations do not take them into account.	It is standard practice to assign a financial value to non-monetary benefits such as safety and weigh this against the resource cost. There is no reason why this should not apply to spectrum as to other resources.
Ofcom should intervene to avoid chaos of competing standards.	Regulators may well not select the best standard and intervention can delay innovation to the detriment of consumers. In general, competition is more likely than regulation to secure optimal outcomes.
VHF and other maritime frequencies should not be tradable. Only four channels are available for inter-ship communications and the number of users is rising.	VHF maritime frequencies raise particular issues because of international obligations and the fact that they are used by foreign-flagged as well as UK-flagged ships and certain bands might not be suitable for trading by individual licensees. This does not necessarily rule out granting tradable RSA in the bands. We will consider this further with the DfT and MCA.
Public bodies might not have the expertise to engage in spectrum trading and management.	We expect public bodies to acquire sufficient resource to manage the spectrum. This might involve a third party band manager to advise them.
Radio Amateurs look to Ofcom to facilitate discussions and clear notices of variation in liaison with primary users, engage on international matters and generally manage Amateur allocations. Ofcom should continue to play a role. Most bands do not have a single exclusive incumbent creating a more complex starting scenario.	We currently intend to continue to exercise the same functions as at present in relation to Amateur radio in terms of international representation and liaison with the MOD.
Question 2: what factors should Ofcom take into account in determining the programme of reform?	
Many factors were suggested including the following. MOD spectrum demand study WRC agenda item 1.4 on spectrum for advanced nomadic and mobile wireless Radar protection criteria Industry requests for 'pioneer' licences Military band sharing trials	We agree that many of these factors are relevant to decisions on future public sector spectrum use. Not all of them, however, directly relate to Ofcom's functions under the new framework. Many relate to decisions that will fall to be taken by individual public bodies about future spectrum release or sharing. Others concern aspects of Government policy, for example on trade, international competitiveness,

Issue raised in response to the consultation	Our observation or conclusion
Development of technology-neutral SURs Protection for 'early movers' Safety impact International policy and effect on trade and UK competitiveness Implications for shipping and aviation Costs to end-users Network resilience and coverage for essential services Impact on charitable search and rescue organisations Public safety and national security International coordination and time to secure consensus Incumbents' quality of service and avoidance of interference Benefits for citizens and for the economy Complexity of the process and regulatory burden Cost to users of changes to equipment Health risks Scrutiny of trading proposals so that one public body does not release spectrum needed by another Maritime policy Environmental impact Suitability of public bodies to engage in the market Fiscal and spending constraints on public bodies The RSPG Opinion on public service spectrum use Competition and risk of spectrum hoarding	aviation, shipping and the environment. Shipping and aviation are economically significant and strategically important but there are many other users of spectrum that generate substantial economic benefits for the UK and Ofcom has a duty to take all their needs into account. The Government has stated that national security and public safety will remain paramount. The new framework will be consistent with this and also with continued compliance with international obligations and avoidance of harmful interference. The outcome of the technical work on radar band sharing criteria will be highly relevant in this respect. 'Early movers' will benefit from the measures against harmful interference from later sharers. Establishment of inter-departmental machinery for public bodies to ensure a coherent approach to public sector spectrum requirements is a matter for the Government. Provision of resources to enable public bodies to engage with the market for spectrum is also a matter for the Government. We will aim to make the trading and conversion processes as simple as possible and to avoid unnecessary regulatory burdens. We are actively engaging in work on developing the RSPG Opinion on public service spectrum.
Question 3: should the proposals be phased in?	
Phasing should be adopted to allow risks to be identified, experience to be gained and the framework to be revised if necessary. But frequent small changes would be counter-productive and phasing should proceed by substantial steps with time allowed for public bodies to adjust.	We agree with the principle of phasing as explained in section 6 of this statement and will consult further on the size of the initial phase when the MOD's plans are clearer.
International obligations are likely to require implementation to be phased.	We agree that international obligations should be a factor in phasing.
Question 4: do you agree with Ofcom's proposals about the frequency bands that offer greatest benefits from band sharing?	
It is difficult to say whether the three bands identified will offer the greatest potential over time but they are a reasonable starting point. The 450 to 470 MHz band would also provide benefits from early release in view of its suitability for digital technologies.	The PSSPG has concluded that spectrum in the 450 to 470 MHz band currently used for emergency and public safety services needs to be retained at present. However, consultants Mott MacDonald have been commissioned to advise on whether some or all of the rest of the band may be reconfigured, which could result in some of this band becoming available.
The radar band at 1.4 GHz should be a high priority.	We note the interest in this band and will take it into account. The Independent Audit concluded, however, that there was unlikely to be scope for

Issue raised in response to the consultation	Our observation or conclusion
	unilateral UK sharing or release in radar bands between 1215 MHz and 1375 MHz.
The 2.7-3.6 GHz bands offer the greatest potential benefits as they are suitable for wireless broadband and could play a significant role where fibre or cable are unavailable. However, they are also subject to complications from the presence of safety-related systems and military, including NATO, use. L-band (1215-1350 MHz) also includes safety services and 4.2-4.4 GHz is used for radio altimeters, which are safety-related, internationally coordinated with no prima facie scope to reduce bandwidth. Maritime S-band radar is carried on ships, which are not generally found inland although they do sail along rivers and canals and there might be a small number of inland special purpose or experimental systems using this band there. X-Band radar carried by small boats would be more problematic inland because of the presence of airport surface movement detection radar.	We agree with this assessment of the attractiveness of the frequencies around 3 GHz. The gains are potentially substantial but we accept that releasing or sharing may be challenging. We will discuss further with the MOD, CAA and MCA how to proceed.
There is an inconsistency with Ofcom's position opposing designation of the 2.7 GHz band for future mobile systems (WRC07 agenda item 1.4). Successful band sharing trials demonstrate the feasibility of sharing the band.	We explained our position in our statement of 7 June 2007. We remain of the view that implementation of the Independent Audit is not dependent on adding a mobile allocation in the band at this time. It will be necessary to complete and reach firm conclusions on band sharing trials before making proposals to lift the international constraints. This requires further work.
There are bands in which government user requirements have severely restricted use, eg mandating dynamic frequency selection in 5.4 GHz and 5.8 GHz (since relaxed in latter band). The challenge is to ensure that, given these restrictions, band sharing leaves non-military users with sufficient spectrum rights to support a viable business.	We agree that it is important that restrictions on spectrum release and sharing are kept to a minimum consistent with safeguarding essential public use from harmful interference. The proposals will give public bodies the opportunity and incentive to meet this challenge.
International harmonisation and availability of standardised equipment are important enhancers of spectrum value and can give rise to economies of scale for both commercial and public sectors, for example around 3 GHz for next generation mobile and at 4.4-5.0 GHz for public service broadband, which would align with the USA public safety band.	We broadly agree with these comments.
It will be necessary to allow for potential future developments in order to avoid difficulty experienced in the USA where bands that had been released for commercial communications were later designated internationally for marine use.	We note this point and will endeavour to ensure that future international developments are taken into account.
Question 5: do you agree with Ofcom's proposed approach to awarding public sector licences and RSA?	
Several respondents expressed the qualification that further detail is required to enable a full response. Experience with radio astronomy RSA is limited. There is little flexibility in maritime bands as most are internationally harmonised.	We accept that further work is needed to specify the detailed design of the new framework and will carry this out when the departments and other public bodies concerned have further defined their arrangements for holding, managing and releasing

Issue raised in response to the consultation	Our observation or conclusion
Others also commented that more detail was needed to allow a meaningful response.	their spectrum holdings.
It needs to be made clear in advance whether conversion of RSA to WT licences or vice versa will introduce additional conditions or obligations (eg on the application or technology permitted) that may affect the value of the spectrum.	We intend to make RSA and licences as technology and application neutral as possible. We agree that it will be necessary to state clearly the nature of any restrictions that apply in advance of transactions being entered into and will do so.
The process is in danger of being too slow. Ofcom should introduce a 'miscellaneous licence class' to bridge the gap between non-operational licences for non-commercial development and operational licences that can be used for commercial services.	We agree on the importance of making the processes as smooth as possible. However, we are not persuaded that it would be advantageous to create a new class of licence. Direct engagement with the market is likely to be faster than awards by Ofcom as explained in section 4 of this statement.
Further detail is required on the process for varying RSA. Some flexibility needs to be retained by Ofcom but too much could reduce the economic value of the holdings. It will be important to define and implement the conversion process between RSA and licences as a matter of urgency.	We will make information available about the conversion process before the framework is introduced.
Limitations on Ofcom's ability to guarantee quality of spectrum or service in adjacent bands are a concern. It will be difficult to achieve technology neutrality in the radar bands without mutual interference, including between maritime (short pulse) and other radar technologies. This will be difficult in S-band and even more so at X-band.	Work is in hand to define spectrum rights in the radar bands to be as flexible as possible while avoiding unacceptable interference. We will publish our proposals in due course.
There might be advantage in having a band manager in some bands. Some of the spectrum under consideration is likely to provide greater benefits if used by the public sector, eg to improve emergency service communications.	Public bodies will be able to choose to employ a band manager if they wish. Decisions on whether to retain or release spectrum will be taken by the public bodies concerned.
Public sector holdings should not be transferable to non-aviation applications in bands used for aeronautical safety of life applications.	It would be excessively rigid and disproportionate to rule out change of use in such bands and could result in sub-optimal use of spectrum. Changes in technology, for example, might allow spectrum release or sharing without compromising safety and, as discussed above, it might be possible to reorganise certain bands to create unencumbered spectrum for release.
The secondary market could possibly be pump-primed by transferring rights to intermediaries. Many public sector requirements are geographically limited providing scope for sharing with commercial users.	Intermediaries could play a role and it is envisaged that the new framework will allow them to do so.
Question 6: should public sector spectrum trading be introduced at this stage in the Channel Islands and Isle of Man?	
Geographical proximity and other circumstances could make extension there advantageous but is not imperative and should not be allowed to delay the proposals. Technical trials should be carried out to ascertain the cross-border effects.	As stated in section 6 of this statement, we have not yet reached a conclusion on this matter and will discuss it further with the administrations involved. The introduction of spectrum trading in Jersey and the Isle of Man would require an Order in Council

Issue raised in response to the consultation	Our observation or conclusion
The Channel Islands and Isle of Man should be included as they are part of an integrated maritime system subject to the same international regulations and limitations on spectrum trading.	before we could make the necessary regulations. The CAA will liaise with the French air traffic control as necessary to coordinate frequency use for aviation.
The London and Scottish flight information regions (FIRs) include en route traffic over the IoM. There would be concern if changes compromised air traffic operations around the IoM. The Channel Islands are within a French FIR and the French air navigation service (DSNA) might have views. Territorial rights sought by the MOD might differ from those specified in a licence granted by Ofcom where territorial waters of flight information regions vary or are subject to international agreement. Ofcom should consider introduction of spectrum trading as widely as possible.	
Because of the proximity of the UK to the Isle of Man and Channel Islands, care should be taken in planning the spectrum that interference does not compromise search and rescue operation.	
Radio signals do not recognise political boundaries so the Crown Dependency administrations should be fully involved in discussions.	
Question 7: should there be additional grounds, eg safety-related, for Ofcom to refuse consent for a proposed trade in certain frequency bands or for certain applications?	
Several respondents consider that Ofcom should have power to refuse consent to trades on safety grounds. Ofcom already has this power in relation to national security. If safety is added in relation to public bodies, it should apply also to the commercial sector. Trades should not be permitted if they would affect the quality of service of any existing users, especially where safety of life is concerned. Sharing should not be allowed in safety-critical bands unless the safety case has been met.	Whether we should be able to withhold consent on grounds of public safety is discussed in section 7 of this statement. For the reasons given there, we do not currently consider such a ground to be necessary but will discuss this further with the DfT, CAA and MCA.
Responsibility for trading and liberalisation should remain with Ofcom. It would be inappropriate to regulate trading under the Air Navigation Order (ANO). Another respondent disagreed, seeing it as problematic for Ofcom to assess safety.	For the reasons given in section 7 of this statement, we are not currently minded to conclude that the trading regulations would be an appropriate or effective way of regulating air safety. No evidence has been brought forward as to why the ANO would be unsuitable for regulating in respect of any effects of spectrum trading on air safety if spectrum trading was extended.
If safety was not a ground for refusal, it could be considered only at the time of initial release and not for subsequent trades. A more conservative approach would have to be taken to the initial trade	As discussed in section 7 of this statement, decisions on whether and how much spectrum to release will be taken by the responsible public body, which can be expected to have regard to

Issue raised in response to the consultation	Our observation or conclusion
and release would be more difficult. Further work would be needed to define safety-related criteria and the circumstances in which consent might be withheld so those contemplating acquiring spectrum could judge how readily they might in turn trade it.	these matters. If it later requires additional spectrum, it would usually acquire that through the market. In exceptional cases, the Secretary of State could direct Ofcom to make it available administratively.
Frequencies used in maintaining safety of the coast should be exempt from liberalisation. Beach lifeguards use some of the frequencies to communicate with search and rescue and coastguards and their ability to do so should not be compromised.	We will consider the application of liberalisation policies on a case by case basis as we progressively apply the new framework. It is relevant to note, however, that decisions on release of spectrum will be a matter for the organisation holding the spectrum. They will be able to take their operational requirements into account, including for communication with lifeguards, in deciding whether and on what terms to release or share spectrum.
Trades that may impact on property, cargo or national security should be disallowed.	As explained in this statement, national security will remain paramount. Any impact on property or cargo, however, is in general better left to the prospective transferor to judge.
Damage to the environment should be taken into account.	Protecting the environment is clearly of substantial importance in public policy terms. But the linkage with individual spectrum transactions is indirect and difficult to predict. Environmental impact is not a factor that Ofcom is required by section 3 of the Communications Act 2003 to take into account in exercising its functions. For this reason, we do not consider that environmental impact should be a ground to refuse consent to a proposed transfer.
Change of use can give rise to interference as happened in the USA in the 800 MHz band as a result of changes in network configuration. This could be relevant to frequency bands in which the MOD shares with civil aviation and maritime systems and should be taken into account in assessing proposals for change of use in order to avoid impairing safety.	We will use our best endeavours to define RSA boundary conditions so that changes of use do not give rise to harmful interference. Where a licence variation is necessary to allow a change of use, our usual procedures for liberalisation will operate to manage risk of interference (see Ofcom's statement of 26 January 2005 on spectrum liberalisation).
Ofcom should ensure that public agencies have sufficient spectrum to meet operational needs.	In accordance with the Government's response to the Independent Audit, it will be for the public bodies concerned to retain or acquire through the market sufficient spectrum to meet their operational needs. In exceptional cases, Ofcom may be directed by the Secretary of State to make spectrum available administratively.
International obligations	Current trading regulations allow us to withhold consent to proposed trades on grounds of incompatibility with international obligations and we anticipate that this will be proposed as part of the new framework.
Ofcom should clarify provisions in licence terms and	We agrees that it is desirable for there to be clarity

Issue raised in response to the consultation	Our observation or conclusion
conditions that allow the Government to take back spectrum for emergency or national security reasons and ensure that these are consistent.	and consistency in this important matter and will discuss further with the MOD what, if any, changes are required.
Other issues	
Charging AIP would not improve spectrum efficiency in the aviation sector. Airlines have already implemented 8.33 KHz channel spacing in VHF bands and aviation use of spectrum is determined by national governments through the ITU. Applying AIP to aviation would be unnecessary and inappropriate.	The consultation was about spectrum trading. We will be consulting shortly on applying AIP in the aviation and maritime sectors and will address this issue then.
Spectrum for vhf communications or radar should not be subject to spectrum pricing. VHF and radar are safety systems that are extensively used by leisure sailors as well as by the RNLI and MCA. No further charges should be made for these applications as leisure sailors might cease using radio communications and radar. Where incentives do not result, reflecting opportunity cost in AIP is inappropriate.	See above on the general issue of applying AIP in the maritime sector. See section 3 on the specific issue of ship radio licence fees, where we make clear that we have no current plans to propose a change to the basis for charging for ships.
Different charging principles should be applied to maritime use than to commercial communications networks. It would be inconsistent and impracticable to introduce AIP for ships' radio having recently introduced free lifetime licences. Ofcom should continue with free licences.	See above.
There is an issue of how to collect revenue for spectrum use from visiting ships in transit in UK territorial waters.	See above.
If AIP is to be introduced for ships, this should take the form of a one-off lifetime fee instead of an annual charge.	See above.
En route air traffic services operate within a revenue-capped regulatory environment. The CAA will determine (and has not yet agreed) that AIP charges may be passed on to customers. The AIP charge if passed on would be similar to existing UK air navigation charges. This could place UK aviation at a competitive disadvantage relative to Europe and could lead airlines to detour around UK airspace with adverse environmental consequences.	See above.
Ofcom should not be able to raise revenue from spectrum used for safety services as this constitutes a conflict of interest that could compromise safety.	AIP has been applied to E&PSS services for nearly a decade. We are not aware of any evidence that such a conflict has arisen. Ofcom has a duty to secure optimal use of the radio spectrum. AIP is an important tool to achieve this and is applicable to E&PSS as to other radio users in the public and private sectors. The Independent Audit and Government both agree.

Issue raised in response to the consultation	Our observation or conclusion
If the MCA or maritime administrator was responsible for upholding safety and trading maritime spectrum, this would represent a conflict of interest.	The Government has repeatedly emphasised that safety will remain paramount and MCA, as an executive agency of the DfT with statutory responsibility for maritime safety can be expected to act accordingly.
The voluntary search and rescue sector should be considered sympathetically. They might not be able to afford digital equipment or might require time to do so.	The voluntary emergency service sector currently receives discounts on AIP. We will address this issue in the forthcoming maritime and aviation AIP consultation.
Early movers should be granted spectrum at nominal value to promote take-up. AIP should take account of the release of newly shared bands. This will prevent prices becoming too high.	We are not aware of evidence that would justify discriminating in favour of early movers by offering them preferential terms for spectrum access. We review levels of AIP periodically to ensure that they are set at an appropriate level having regard to the factors mentioned in section 13 of the WT Act.
This consultation should not have preceded that on AIP.	This consultation concerns the framework that is adopted for public bodies to acquire, hold, share and release spectrum. It has implications for some aspects of AIP so it was sensible to consult on it before AIP. We will progress the two workstreams in a coherent manner.
In table 3.1, it is implied that PSSPG plans assignments. In fact, Ofcom plans emergency service assignments.	We have amended the table to clarify that Ofcom plans assignments on advice from the PSSPG.
Ofcom should reflect the comparability of commercial and public body spectrum fees in relation to proposed increases between 470 MHz and 3 GHz. Lack of information from Ofcom on AIP rates for some public sector holdings has made it difficult to formulate realistic estimates to factor into the Home Office's CSR bid. There needs to be greater engagement between the parties concerned on proposed substantial fee increases above 470 MHz and an agreed way forward before Ofcom imposes these.	We are aware of concerns about prospective changes to AIP paid by E&PSS aimed at making payments more comparable with private sector users. We propose to conduct in collaboration with E&PSS stakeholders a review of E&PSS AIP rates and the fee-setting process and to conclude this in the first quarter of 2008.

Annex 2

Respondents to the consultation

A2.1 Following is the list of respondents excluding fifteen who asked that their identities be withheld.

A2.2 The responses may be found at http://www.ofcom.org.uk/consult/condocs/sfrps/responses/. None were confidential.

Aeronautical Rescue Coordination Centre

Arqiva

BandSharing Forum

British Ports Association

BT plc

Chamber of Shipping

Civil Aviation Authority

Department of Communities and Local Government

Department for Transport

Easton, Mr Howard

Edward, Mr Ian

General Lighthouse Authorities

Hicks, Mrs

Institution of Engineering and Technology

Intellect

International Air Transport Association

Janina of Dorset

Maritime and Coastguard Agency

Ministry of Defence

Motorola Ltd

National Air Traffic Services

National Beach Safety Council

National Physical Laboratory

National Policing Improvement Agency

Nomad Forum

Power, Mr R

Protect Marine Frequencies

Public Safety Spectrum Policy Group

Radio Society of Great Britain with UK Microwave Group, Amsat-UK and BATC

Royal National Lifeboat Institution

Robb, Mr Christopher

Rolfe, Mr David

Royal Yachting Association

Scottish Government

Sea Safety Advisory Group

Sneddon, Mr Iain

Taylor, Mr Tom

Tumore, Mr David

Vincent, Ms Clarissa

Welsh Assembly Government

Willis, Mrs Janeen

Annex 3

Impact Assessment

Introduction

A3.1 The analysis presented in this annex represents an impact assessment, as defined in section 7 of the Communications Act 2003 ('the Communications Act').

A3.2 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 Ofcom's activities. However, as a matter of policy Ofcom is 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: http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf.

A3.3 We requested comments in the consultation on our preliminary impact assessment. One respondent commented specifically on the impact assessment that further work is needed by the UKSSC or another official body to make a full assessment of spectrum trading opportunities and benefits.

A3.4 We agree that it is desirable that public bodies that are considering whether to release or share their spectrum holdings should make a full assessment of the costs and benefits, both financial and operational. However, we do not believe it is necessary, or would be practicable, to carry out a detailed analysis of trading opportunities before beginning to introduce the new framework. The communications sector is changing rapidly in unpredictable ways. It is important that public bodies have the incentive, and are enabled, to take advantage of opportunities as they arise. Putting the new framework in place as soon as possible will benefit citizens and consumers by accelerating innovation and enhancing competition and allowing them to enjoy the resulting gains sooner rather than later.

The citizen and consumer interest

A3.5 We have carefully analysed the citizen and consumer interest and given it due consideration in the preparation of this consultation in conjunction with the impact on business. We have identified the following areas in particular where the issues raised may have an impact on citizens and consumers and these have informed our analysis in this document.

- Generally speaking, the user that is willing to pay the highest price will be the one that can generate greatest benefits from a spectrum assignment. This implies that spectrum trading, by providing a mechanism for spectrum to be transferred to those that value it most, will allow efficiency enhancing trades to be identified and result in a more economically efficient outcome that benefits citizens and consumers.

- A grant of RSA is an instrument that we can introduce for Crown and other bodies to recognise their spectrum use where this is not licensable and will allow

the benefits of trading to be extended subject to any constraints that the public sector transferor may place, or is required by its duties to place, on the use to be made of the transferred spectrum.

- More efficient use of spectrum by the public sector should reduce the amount paid by public sector bodies for access to spectrum and also provide an opportunity for them to benefit from more efficient use of their spectrum holdings.
    - This will benefit citizens by enabling public services to be provided at lower cost to the taxpayer and to the economy.
    - This is subject to the crucial proviso that essential defence, emergency and safety-critical services are not unacceptably affected.
- More efficient use of public sector spectrum and the potential for greater band sharing will enhance opportunities for commercial undertakings to access radio spectrum and so is likely to help accelerate market entry by new wireless services.
    - This will benefit consumers by increasing competition, innovation and choice in communications services, which will lower prices and provide consumers with a wider range of commercial services while maintaining essential public services.

Ofcom's policy objective

A3.6 Our objective is to secure optimal use of the radio spectrum by providing incentives for public sector bodies to use spectrum more efficiently and to enable them more easily to enter into band sharing arrangements with commercial undertakings.

A3.7 The success of this policy will depend on a number of unknowns, including the willingness of public and private sector spectrum users to enter into arrangements that allow for the release or sharing of public sector spectrum holdings.

A3.8 The timeframe for the policy to take effect will depend to a considerable extent on the use made by both public sector bodies and commercial undertakings of the opportunities to share spectrum. This cannot be predicted with certainty. The proposed changes represent a substantial innovation in the way in which the public sector manages spectrum and it could take some time for a mature market with substantial depth and liquidity to develop.

A3.9 The Government's *Forward Look*[55] contains forecasts of anticipated changes in public sector spectrum requirements and indicates where spectrum sharing opportunities are likely to become available. Further work is in hand to define these. The MOD, which the largest public sector spectrum holdings, has committed to releasing a "significant proportion" of its holdings to the market and will by May 2008 publish its detailed plans for doing this.

Options considered

A3.10 The options have been identified and considered may be characterised in terms of whether or not public sector spectrum holdings are tradable and whether or not they are defined in technology and application neutral terms ('liberalisation'). Closely

[55] http://www.spectrumaudit.org.uk/pdf/Forward_Look_2007.pdf

related to this is the issue, discussed in section 4 of this statement, of the advantages of direct engagement with the market by public bodies. Other significant issues addressed in this statement are:

- whether to phase in the changes on a band-by-band basis or to introduce them across all public sector spectrum holdings at the same time as discussed in section 6; and

- whether or not to introduce RSA for Crown bodies.

Trading and liberalisation

A3.11 We have considered three options.

Option 1 Do nothing: most public sector users already pay AIP and would continue to do so but spectrum trading would not be introduced in the public sector. We will be consulting separately on extending AIP in the civil aeronautical and maritime sectors.

Option 2 Introduce spectrum trading combined with liberalisation (ie removal of restrictions on the service that may be provided and the technology that may be used).

Option 3 Introduce spectrum trading without liberalisation.

A3.12 The benefits of spectrum trading and liberalisation are discussed in the main body of this document and in other Ofcom publications and are summarised in paragraph A3.5 above. To achieve the full benefits from the proposed changes, it will be necessary to allow change of use ('liberalisation') as well as change of ownership through trading, especially as, in the case of radar in the economically important frequencies around 3 GHz, the main gains are expected to flow from the use of the spectrum for alternative applications. A study for the European Commission[56] estimated that the benefits of spectrum trading and liberalisation combined are about nine times those from trading alone. We therefore conclude that it would in general be beneficial to extend both trading and liberalisation to public sector spectrum holdings, subject to safeguards to ensure that national security and public safety remain paramount as outlined elsewhere in this statement.

A3.13 A key point in this connection is that it will be a matter for the public bodies concerned to decide whether and on what terms to enter into trading or sharing arrangements. They will judge how much spectrum they need to retain for essential operational purposes and while maintaining public safety and national security. It seems reasonable to assume that the responsible public bodies will satisfy themselves that the transactions that they enter into will not have unacceptable effects. In addition, they might be able to intervene directly using their own powers where necessary to ensure that spectrum was not released if this would have an undesirable effect on safety. They will also be involved in devising band sharing criteria.

A3.14 No assumptions are made in this impact assessment about the introduction or extension of AIP to the aeronautical and maritime sectors. This will be the subject of a separate impact assessment.

[56] *Study on conditions and options for introducing secondary trading of radio spectrum in the European Community*, by Analysys Consulting Ltd, DotEcon Ltd and Hogan & Hartson LLP at http://ec.europa.eu/information_society/policy/radio_spectrum/docs/ref_docs/secontrad_study/secontrad_final.pdf

Costs and benefits

A3.15 The benefits and costs flowing from the new policy and from each of the options will depend on decisions to be taken by public and private sector stakeholders and by the Government itself. It is therefore not possible to provide accurate quantitative estimates of these. It can be said, however, that the advantages of greater spectrum efficiency and enhanced opportunities for commercial services to access spectrum could be substantial and might be of the order of £1bn a year[57], although such estimates are difficult to quantify and are subject to wide margins of uncertainty. The Independent Audit estimated that the total current market value for public sector spectrum holdings could be between £3bn and over £20bn depending on methodology subject to the caveat that calculating spectrum value is difficult because of the early stage of development of the spectrum market and because the value of spectrum will depend on the physical characteristics of the frequency in question and on past regulatory decisions. We conclude that the potential benefits from spectrum trading and liberalisation in the public sector are real and significant even if they cannot be precisely quantified.

A3.16 Costs may be considered under three headings.

i) The costs to the public sector of managing their spectrum holdings and to Ofcom. It will be necessary for public sector bodies to carry out detailed audits of their spectrum needs and to actively manage their spectrum holdings. This may require investment in systems and specialist staff or procurement of spectrum management services from outside contractors. It is for the Government to decide as a matter of policy to commit the necessary sums to this if it considers that the benefits to the economy as a whole will be in excess of the costs incurred. By way of background, the impact assessment for spectrum trading[58] assumed that costs of trading in the commercial sector would be about 5% of the total benefits. It will be for the Government to make available the resource public bodies need through the usual budgetary and public sector financial control processes.

   The costs to Ofcom are unlikely to be significant relative to the potential benefits. The impact assessment for spectrum trading estimated that the set-up costs associated with the introduction of spectrum trading across all licence classes would amount to about £2.8m with ongoing administrative costs of around £300,000 a year. Those incurred in connection with trading public sector spectrum holdings are likely to be comparable or lower.

ii) Transaction costs associated with trading and sharing where such transactions are entered into. The transaction costs incurred will be voluntary in that there will be no compulsion to lease or trade and the parties would not enter into such arrangements unless it was to their mutual advantage to do so. The impact assessment produced for the consultation on spectrum trading[59] estimated that the costs of spectrum trading in the private sector would be likely to be far outweighed by the benefits, even on a relatively conservative basis. There is no reason to assume that this conclusion would be fundamentally different in the public sector although there might be additional expense associated with producing the safety case for sharing with safety-critical applications.

[57] Derived from the study referenced in preceding footnote assuming that the benefits to the UK equate to approximately 1/6th of the benefits to all Europe
[58] http://www.ofcom.org.uk/consult/condocs/spt_wtr/statement/stwtr.pdf
[59] http://www.ofcom.org.uk/consult/condocs/spec_trad/

iii) Opportunity costs of withholding spectrum from potential higher value uses. These are discussed in greater detail below.

A3.17 In addition, there is a risk spectrum trading might give rise to a market failure in which a public service has insufficient spectrum to operate effectively and maintain the desired standard of its service or that insufficient spectrum is available to achieve a particular public policy objective or provide the optimal amount of a public or merit good. We do not think this is a significant risk. Public bodies holding spectrum will themselves be best placed to ensure that they acquire and retain sufficient spectrum to meet their operational needs, statutory duties and policy objectives. Decisions on spectrum release or sharing will be considered collectively by departments, for example in the UKSSC. The Secretary of State can direct Ofcom to make spectrum available if necessary in the interests of national security, public health or compliance with international obligations.

A3.18 In view of the uncertainties referred to above in estimating trading and liberalisation outcomes, we do not consider that it would be proportionate or helpful to attempt to quantify costs and benefits for each of the options. Instead, the following table presents a qualitative analysis of benefits, costs and risks reflecting the discussion in the main body of this document.

Table A3.1: Benefit, cost and risk analysis for spectrum trading and liberalisation

Benefits	Costs / risks	Management / mitigation
Option 1 Do nothing - no spectrum trading or liberalisation		
Stability: no change to management of spectrum – absence of costs or risks associated with change	No positive incentives from potential gains from trading Spectrum not transferred to uses and users of greatest value Competition, innovation and consumer benefits foregone or delayed Shortages of spectrum for public and commercial services	Can increase incentives for spectrum efficiency through applying AIP or CSR targets but this is likely to be less effective alone than if complemented by trading and liberalisation Released spectrum can be returned to and awarded by Ofcom Costs could in principle be partially mitigated by more dynamic regulatory assignment but scope for this is limited
Option 2 Introduce spectrum trading and liberalisation for public sector holdings		
Trading and liberalisation enable spectrum to migrate to uses and users that value it most Innovation and competition promoted as new services gain access to spectrum more quickly than by regulation Allows direct engagement with market by public	Trades might take place in environment of limited information and not lead to most efficient outcome	Ofcom will provide information to the market in WT Register and Transfer Notification Register
	Spectrum is traded without consideration of international obligations	Ofcom will be notified of trades and could be empowered to withhold consent for trades that contravene international obligations

Benefits	Costs / risks	Management / mitigation
sector bodies to release and acquire spectrum Enhanced spectrum efficiency Enhanced public sector efficiency	Interference from band sharing compromises public safety or national security	Decision on whether to trade and technical restrictions that apply will be decided by public sector body concerned. Trials and studies in hand to define safety criteria for sharing.
	Release of spectrum compromises operational effectiveness, public safety or national security	Decision on whether to trade and technical restrictions that apply will be decided by public sector body concerned. Regulatory and other tools available to uphold public safety directly. Release on time limited basis, subject to pre-emption rights or on concurrent basis would provide transferor with assurance of future access if required.
	Disclosure of sensitive information prejudices public safety or national security	We will discuss with Government information to be placed on WT Register and withhold sensitive information
	Public sector users have insufficient resource to manage their holdings	Public sector bodies can bid for resource they require in the usual way through the budgetary process. Scope for public-private partnership.
	Public sector bodies have insufficient spectrum	Bodies can assess their needs and choose not to trade. They will also be able to acquire more spectrum through the market. If necessary, Ofcom could be directed to assign spectrum administratively.
	Market mechanisms provide insufficient incentives for spectrum efficiency in public sector	Government has made clear its intention to put proper and effective incentives in place. These can be augmented by CSR targets. Effectiveness of policy will be reviewed in 2012.
	Excessive transaction costs or burdensome procedures	We will aim to minimise transaction costs and administrative burdens.
	Release of spectrum conflicts with broader policy considerations or international developments Market failure leads to undesirable outcome	UKSSC will consider wider policy issues. We will advise and participate in UKSSC. Regulatory intervention to correct market failure where necessary
	Trading leads to anti-competitive outcome	General competition law available to deal with anti-competitive behaviour

Benefits	Costs / risks	Management / mitigation
	Unforeseen consequences of change	We will consult with stakeholders and be ready to revise procedures if necessary. Phasing (see below) will mitigate this risk.
	Excessive restrictions on spectrum access inhibit beneficial change of use	Restrictions in licences and RSA will be kept to the minimum necessary. Public bodies will have incentives not to impose unnecessary restrictions when they trade.
Option 3 Spectrum trading without liberalisation		
Trading allows spectrum to be transferred to those who can use it to generate most value from the same use	Lack of liberalisation means that changes of use cannot take place unless the transferee's licence is varied Benefits of liberalisation – an estimated 90% of total benefits of option 2 - are foregone or delayed	Make licence variation process as dynamic as possible but this is unlikely to be as effective as option 2
	Risks of trading as for option 2	Mitigating measures as for option 2

A3.19 Option 1 represents the *status quo*. Where AIP is applied to public sector spectrum holdings, public sector users will have an incentive to return surplus spectrum to Ofcom or to allow Ofcom to award licences that share spectrum as they will then pay a reduced fee. However, they will have less of an incentive than if they could enter into arrangements direct with commercial sharers and receive income from this. Also, spectrum release or sharing could take place only by returning spectrum to Ofcom to award, which would be more cumbersome and could delay or prevent beneficial transactions from taking place.

A3.20 Option 3 would enable spectrum to transfer to those that can generate greater benefits from the same application but, as discussed above, the lack of flexibility would substantially reduce the potential gains by an estimated 90% based on the study carried out for the European Commission.

A3.21 We believe it is far more likely than not that trading and liberalisation will be effective and advantageous in the public sector provided that effective measures are in place to avoid unacceptable effects on public safety and national security. As this statement makes clear, public safety and national security will remain paramount.

A3.22 It seems likely that there would be less band sharing under options 1 ('do nothing') and 3 ('trading without liberalisation') than under option 2 (trading with liberalisation'). Public sector users would forego the income from spectrum trading; commercial bodies would gain less access to spectrum and have reduced opportunities to launch new wireless services; consumers would gain less from innovation and competition; and citizens would forego public sector efficiency gains.

A3.23 Assuming that option 2 will have a greater effect in terms of facilitating access to spectrum, adoption of any other option would incur an opportunity cost equal to the additional benefits foregone compared to that option. There would be fewer opportunities for commercial users to access spectrum and innovation and competition would be held back.

A3.24 We therefore conclude that there are good grounds to conclude that option 2 is more likely than the alternatives to secure the socially optimal outcome.

Conclusions on trading and liberalisation

A3.25 The main risk of not introducing trading and liberalisation is that there will be less efficient use of spectrum and that band sharing between public and commercial sectors will be inhibited. This will reduce innovation and competition and impose costs on citizens and consumers. This is because, without the facility to trade spectrum, the incentives for public sector users to release or share spectrum would be less than if trading was possible as they would be limited to the reduction in spectrum charges. Options involving the introduction of spectrum trading for public sector spectrum holdings seem likely to deliver greater benefits for a range of stakeholders. They are not risk-free but we believe that the risks can be effectively managed or mitigated as set out in the above table. Responses to the consultation broadly support this conclusion with qualifications in many cases as discussed elsewhere in the statement. We will take account of those as we develop the detailed design of the new framework.

Introduction of RSA

A3.26 The costs, benefits and risks associated with extending RSA to Crown bodies are summarised in the following table. Without RSA, spectrum trading would not be available to public sector bodies that are Crown bodies. This would exclude the MOD, which is the main public sector user of spectrum, from trading and result in substantial loss of the potential gains from trading. This would be inconsistent both with the preferred option 2 above and the Audit implementation programme. The only reason to consider it would therefore be if RSA was judged to give rise to costs or risks that were expected to exceed the benefits of trading. This seems unlikely given the scale of the potential gains from option 2 but could be mitigated by introducing RSA selectively.

Table A3.2: Benefits, cost and risk analysis for introduction of RSA

Benefits	Costs / risks	Management / mitigation
Enables trading to be introduced across public sector including Crown bodies Certainty for public bodies that Ofcom will recognise their use of spectrum Comprehensive data base of public sector spectrum holdings	Costs or risks exceed gains for a particular application	Selective introduction of RSA to avoid that application
	Administrative costs of introduction	Not expected to be significant
	RSA might not be taken up by public sector bodies	Government has committed in principle to support introduction of RSA
	Conferring greater certainty on public sector bodies might make them less likely to release spectrum	Trading will provide added financial incentives to release or share spectrum Government support for band sharing as expressed in response to the Audit and *Forward Look* Targets for spectrum release set by CSR

Conclusion on RSA

A3.27 The introduction of public sector RSA is necessary to support the widest possible introduction of trading in the public sector. We consider that the risks associated with public sector RSA are manageable and that the costs are outweighed by the benefits. Responses to the consultation support this conclusion. The detailed scope of the RSA will be subject to a further consultation with the proposed regulations.

Phased introduction or single step

A3.28 We have considered the following two options:

- a phased introduction in which changes are progressively introduced beginning with frequency bands in which the benefits are considered to be greatest and the costs and risks least;
- a single step introduction across all public sector spectrum holdings at the same time.

A3.29 This issue is discussed in section 6 of this statement. The costs, benefits and risks are summarised in the following table.

Table A3.3: Benefit, cost and risk analysis for phasing

Benefits	Costs / risks	Management / mitigation
Phased introduction		
Enables resources to be focused on bands offering most benefits Experience can be gained of operation of reforms	Requires regulator to predict where gains will be greatest Wrong decision will hold back realisation of gains and could impede innovation and competition	Consultation to elicit information about market interest in public sector spectrum holdings
Single step introduction		
Widest possible scope for trading and liberalisation so market can determine how spectrum is used	Higher initial implementation costs Unforeseen consequences for public services	Provide resource through CSR Careful design of new framework

Conclusion on phasing

A3.30 We conclude that the balance of advantage favours a phased approach to initial implementation although we intend to apply the new framework throughout the public sector over time. It is relevant to note that the Independent Audit reached a similar conclusion in its recommendation 2.5 and suggested that bands should be prioritised to maximise the gains from, and minimise the difficulties of, enhancing band sharing by commercial operators. Responses to the consultation support a phased approach.

The preferred option

A3.31 Taking into account the above analysis of costs, benefits and risks, we conclude that, on balance, the phased introduction of spectrum trading and liberalisation

enabled by grants of public sector RSA is the appropriate option to secure optimal use of the radio spectrum. While it carries some risks, these can be mitigated and managed to be acceptable.

A3.32 Estimated costs to spectrum users are low relative to the potential benefits, which could be of the order of £1bn a year[60]. There could be significant costs to public bodies but the Government is budgeting to meet these and they are likely to be less than the potential benefits. The timescale for realising the benefits is difficult to predict but the policy will be subject to review as described below and revised as necessary in the light of the outcome.

A3.33 We will publish a further impact assessment when we consult on draft regulations.

Policy review

A3.34 HM Treasury has undertaken in the response to the Independent Audit to commission an independent review to report in 2012 on the effectiveness of the market-based approach to public sector spectrum management, of which the policies described in this statement form a key part. We will consider in that context the development of metrics to evaluate the outcome of the reforms.

[60] See footnote 54 for source

Annex 4

Spectrum trading modes

Introduction

A4.1 This annex summarises the different ways in which WT licences can currently be traded and that, subject to the outcome of the consultation, could be applied to RSA. The WT Act enables Ofcom to make regulations for the trading and conversion of RSA into licences and vice versa.

A4.2 As discussed above in the main body of this document, spectrum holdings may take the form of licences or RSA. The trading process is essentially the same regardless of the nature of the holding. However, the additional step of conversion will be required if the transaction involves a change from a spectrum holding in the form of RSA to one in the form of a licence or vice versa.

Characteristics and variants of spectrum trading

A4.3 Spectrum trading does not involve the sale and purchase of spectrum as such but is more accurately described as the transfer of rights and obligations appertaining to a licence or RSA in accordance with regulations made by Ofcom. The trading framework is flexible and permits various different types of transaction or 'modes of trading'.

- *Total transfers*: the totality of the rights and obligations are transferred.
- *Partial transfers*: only some of the rights or obligations are transferred.
- *Outright transfers*: the rights and obligations being transferred, whether totally or partially, vest in the purchaser and are relinquished by the vendor.
- *Concurrent transfers*: the rights and obligations being transferred, whether total or partial, extend to both the purchaser and the vendor simultaneously so that the parties have the flexibility to share the rights between themselves as they see fit without the need to undertake further transfers under the trading regulations.

A4.4 In partial transfers, the rights or obligations may be divided by frequency band, geographical coverage or time.

A4.5 The four types may be combined in different ways to create four trading modes.

A. total, outright

B. total concurrent

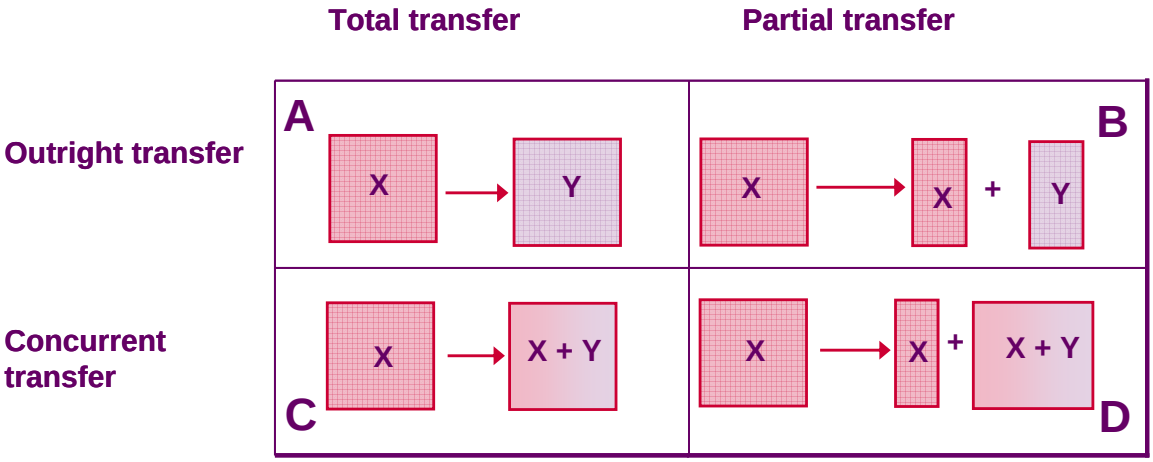
C. partial outright

D. partial concurrent

A4.6 This is illustrated in the following diagram, in which X represents the public sector user and Y the commercial sharer. The choice of mode will depend on the requirements of the parties. For example, if the transferor wishes to retain rights to the holding in parallel with the transferee, this will result in a concurrent transfer.

The parties can also agree contractually that the spectrum will be vacated by the transferee if a certain contingency arises.

Figure 6: Modes of trading spectrum



A4.7 The types of transactions that are permitted and the quanta or minimum units into which assignments may be subdivided in partial transfers are specified in trading regulations. Time-limited transfers are possible but currently involve reversal of the initial trade after a period agreed by the parties to the transaction and possibly specified by contract but we have said that we intend in due course to provide for trades that unwind automatically after a predetermined time without the need for an additional transaction.

A4.8 Both licences and RSA may be made tradable. Current trading regulations permit total transfers, certain types of partial transfers, outright transfers and concurrent transfers in certain frequency bands for specified licence classes. These would have to be amended or new regulations made to allow trading of RSA.

A4.9 It would also be necessary to provide for conversion of RSA into licences and vice versa. Crown bodies do not need licences because the prohibition in section 8 of the WT Act on unauthorised installation or use of such equipment does not bind the Crown. Conversion is necessary in order to authorise a private sector transferee to install or use radio equipment in the spectrum in question.

Annex 5

Glossary

AIP	Administered incentive pricing – setting charges for spectrum holdings to reflect the value of the spectrum in order to promote efficient use of the spectrum
Allocation	Used of a frequency band. Entry in the table of frequency allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radio communications services or the radio astronomy service under specified conditions. This term is also applied to the frequency band concerned.
Assignment	Used of a radio frequency or radio frequency channel. Authorisation given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions.
BERR	Department for Business, Enterprise & Regulatory Reform (formerly the Department of Trade and Industry)
CAA	Civil Aviation Authority – the independent statutory regulator responsible for regulating aviation, including economic and safety aspects
Command and control	A way of managing the radio spectrum in which the regulator makes all the key decisions including what the piece of spectrum is to be used for and who can use it
Communications Act	The Communications Act 2003, which sets out Ofcom's powers, functions and duties
Concurrent	(Of *spectrum trading*) a transaction in which rights and obligations are transferred while continuing to be rights and obligations of the transferor, cf *outright*
CSR	Comprehensive spending review. Part of the Government's framework for setting public expenditure
DCLG	Department of Communities and Local Government
DoH	Department of Health
DfT	Department for Transport
E&PSS	Emergency and public safety services
Exemption	Exemption regulations made by Ofcom allow anyone to use specified radio equipment without the need to have a *WT licence*
FWA	Fixed Wireless Access – means of connecting to homes and offices using wireless as opposed to copper wires or fibre optics
GHz	Gigahertz – unit of frequency equal to one thousand *MHz*
Harmful interference	*Interference* that creates danger or a risk of danger or degrades, obstructs or repeatedly interrupts a transmission or broadcast

Harmonisation	The identification of common frequency bands throughout a region (eg Europe) for a particular application and, in some cases, technology.
Hz	Basic unit of frequency – one hertz is equivalent to one cycle per second
IMT	International Mobile Telecommunications, an *ITU* term embracing IMT-2000 and IMT-Advanced. IMT systems are intended to provide telecommunication services on a worldwide scale regardless of location, network or terminal used. The technical characteristics of IMT-2000 are specified in ITU Recommendations.
Interference	Unwanted disturbance caused in a radio receiver or other electrical circuit by electromagnetic radiation emitted from an external source
ITU	International Telecommunication Union - the United Nations agency for information and communication technology responsible for developing and publishing the *International Radio Regulations*
Market mechanisms	Approach to managing spectrum where key decisions, eg on acquiring or disposing of spectrum and what service to provide are made by spectrum users rather than by the regulator.
MCA	Maritime and Coastguard Agency – an executive agency of the *DfT*
MHz	Megahertz – unit of frequency equal to one million *Hz*
MOD	Ministry of Defence
NPIA	National Policing Improvement Agency
Opportunity cost	The cost of a decision or choice in terms of the benefits which would have been received from the most valuable of the alternatives that was foregone
Outright	(Of *spectrum trading*) a transaction in which the transferred rights and obligations pass to the transferee and are no longer rights and obligations of the transferor, cf *concurrent*
Partial	(Of *spectrum trading*) a transaction in which some of the rights and obligations are transferred while others are kept by the transferor, cf to*tal*
PMSE	Programme Making and Special Events – a class of radio application that supports a wide range of activities in entertainment, broadcasting, news gathering and community events
PSSPG	Public Safety Spectrum Policy Group
PSSTG	Public Spectrum Safety Test Group
Radio Regulations	International Radio Regulations made by the *ITU*, which have the status and force of a treaty, allocate frequencies globally to various applications and deal with cross-border *interference*
Radio spectrum	The portion of the electromagnetic spectrum below 3000 *GHz* that is used for radiocommunications
RSA	Recognised Spectrum Access - a spectrum management instrument created by the *Communications Act* to complement *WT licences*
RNSS	Radionavigation satellite service
Spectrum	The electromagnetic *spectrum* ranging from visible light to x-rays and gamma rays

Spectrum liberalisation	Removal of restrictions from *WT licences* and *RSA* to allow holders greater flexibility to change how they use spectrum
Spectrum trading	Ability of spectrum users to transfer rights and obligations under *WT licences* to another person in accordance with regulations made by Ofcom. Trades may be *total*, *partial*, *outright* or *concurrent*
SQB	Spectrum quality benchmark – an indicator of the level of interference from emissions from other services that a WT licensee or *RSA* holder can reasonably expect to experience
Standardisation	Development of an open standard for a particular type of equipment
STFC	Science and Technology Facilities Council, formerly the Particle Physics and Astronomy Research Council
SUR	Spectrum usage rights – a way of formulating the terms and conditions in a *WT licence* or *RSA* in a way that is independent of technology or service
Total	(Of *spectrum trading*) a transaction in which all of the rights and obligations are transferred from transferor to transferee, cf *partial*
TNR	Transfer Notification Register maintained by Ofcom giving information about *spectrum trading* transactions
UKFAT	The UK Frequency Allocation Table. This identifies responsibilities for the management of frequency bands or services showing whether they are managed by Ofcom, the *MOD* or another Government department or Agency. It also includes the *ITU* Table of Frequency Allocations contained in the current *Radio Regulations*. It is published by Ofcom on behalf of the National Frequency Planning Group, a sub-committee of the *UKSSC*.
UKSSC	Cabinet Office committee that discusses matters relating to the use of the radio spectrum, including by government departments and other public sector bodies
VHF	Very high frequency (30-300 *MHz*)
WRC	World Radiocommunication Conference - conference of the *ITU* that revises or amends the International *Radio Regulations*
WT Act	The Wireless Telegraphy Act 2006, which sets out the statutory framework for management of the radio spectrum consolidating a number of older Acts dating back to 1949.
WT licence	Licence granted by Ofcom to authorise installation or use of radio equipment as required by section 8(1) of the *WT Act*
WT Register	Register maintained by Ofcom containing information about grant, renewal, transfer, revocation or variation of *WT licences* and *RSA*