OFFICE OF COMMUNICATIONS

Spectrum Framework Review: the Public Sector

Proposals to extend market mechanisms to improve how spectrum is managed and used

Consultation

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Section 1

Summary

Introduction

1.1 This consultation seeks views on proposed reforms to how public sector spectrum holdings are managed so as to enhance the benefits that their use generates. For the purposes of this document, these holdings are taken to include spectrum used by civil aviation and maritime operators, whether these are public or private sector.

1.2 The proposals form part of the wider programme to implement the findings of the *Independent Review of Spectrum Holdings* (the 'Independent Audit') led by Professor Martin Cave. The Audit examined spectrum use in the public sector and made a series of recommendations, which the Government and Ofcom have accepted, for reforming the way in which public sector spectrum holdings are managed to achieve greater efficiencies and benefits for UK citizens and consumers. The response from the Government and Ofcom can be found together with the Audit, supporting documents and information about the implementation programme at www.spectrumaudit.org.uk.

New opportunities – sharper incentives

1.3 The theme of the proposals in this document is the creation of new opportunities to promote release or sharing of public sector spectrum holdings and the introduction of sharper, more effective incentives to take advantage of these. This has the potential to enhance spectrum efficiency and make significant amounts of spectrum available for release to or sharing with commercial operators.

1.4 The aim of the proposals is to put in place a market-based framework for public sector spectrum holdings that:

- secures optimal use of public sector spectrum holdings by maximising spectrum efficiency and opportunities for releasing and sharing spectrum;
- reduces regulatory barriers and simplifies processes enabling faster access to spectrum; while
    - o preventing harmful interference; and
    - o ensuring compliance with international obligations (eg EU directives and decisions, ITU Radio Regulations and treaty obligations relating to defence, maritime or aeronautical matters);
- ensures that safety and national security remain paramount and recognises the statutory duties and functions of public sector bodies relating to national security and safety.

1.5 This work complements other initiatives including pioneering technical trials sponsored by Ofcom and supported by the Ministry of Defence (MOD), Civil Aviation Authority (CAA) and Maritime and Coastguard Agency (MCA) to define safety criteria for different wireless communications systems and technologies to share spectrum with radar. Recent trials at Oban and Loch Ewe have yielded useful data to progress this work.

Radio spectrum is a valuable and finite resource

1.6 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[1]. 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[2]. There is also demand from the public sector that has not yet been precisely quantified but is described in the Government's *Forward Look: A Strategy for Management of Major Public Sector Spectrum Holdings* (the "*Forward Look*")[3]. The MOD, which is the main public sector spectrum user holding about a third of the spectrum below 15 GHz, is carrying out a detailed survey of its future requirements.

1.7 Spectrum is an essential input to both the commercial and public sectors. It is widely used in the telecommunications, broadcasting and transport industries and also by the emergency services, military and science. Public sector spectrum holdings amount to nearly half of the total spectrum below 15 GHz. Although valuing these holdings is difficult, it has been estimated that they could have a market value between £3bn and over £20bn[4] depending on the methodology used. It is important that such substantial holdings are managed and used as efficiently as possible and that full advantage is taken of opportunities for commercial users to access them. Failure to do so risks holding back innovation, competition and growth in wireless services to the detriment of citizens, consumers and businesses. The Government has committed in the *Forward Look* to releasing a "significant proportion" of the MOD's spectrum holdings between 2008 and 2010 and the MOD expects to publish its Military Spectrum Implementation Plan, which will identify opportunities to share or release spectrum and how its spectrum holdings will be shared or released to the market, in spring 2008.

1.8 Spectrum trading and liberalisation play a key role as they promote spectrum efficiency by allowing spectrum to be transferred to those users and applications that can generate the greatest benefits. Ofcom is already progressively making commercial spectrum holdings tradable and more flexible in line with its general approach to managing spectrum as set out in its *Spectrum Framework Review*[5] and other documents.

1.9 Extending spectrum trading to the public sector could generate substantial benefits for citizens and consumers. Although spectrum has certain characteristics that distinguish it from other assets, for example vulnerability to interference, there is no reason in principle why public sector bodies should not acquire and dispose of it through the market just as they routinely acquire and dispose of other assets and resources, such as land, buildings and vehicles.

1.10 Many public sector bodies use spectrum to support services that protect safety of life or serve the Government's overall defence and security needs. The proposals in this document are intended to secure spectrum efficiency objectives while maintaining the operational effectiveness of essential services and ensuring that national security and safety remain paramount.

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[1] *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/

[2] *Demand for Spectrum from Non-Government Services 2005-2025* at http://www.spectrumaudit.org.uk/010905.htm

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

[4] *Independent Audit of Spectrum Holdings final report*, page 2: http://www.spectrumaudit.org.uk/pdf/20051118%20Final%20Formatted%20v9.pdf

[5] http://www.ofcom.org.uk/consult/condocs/sfr/

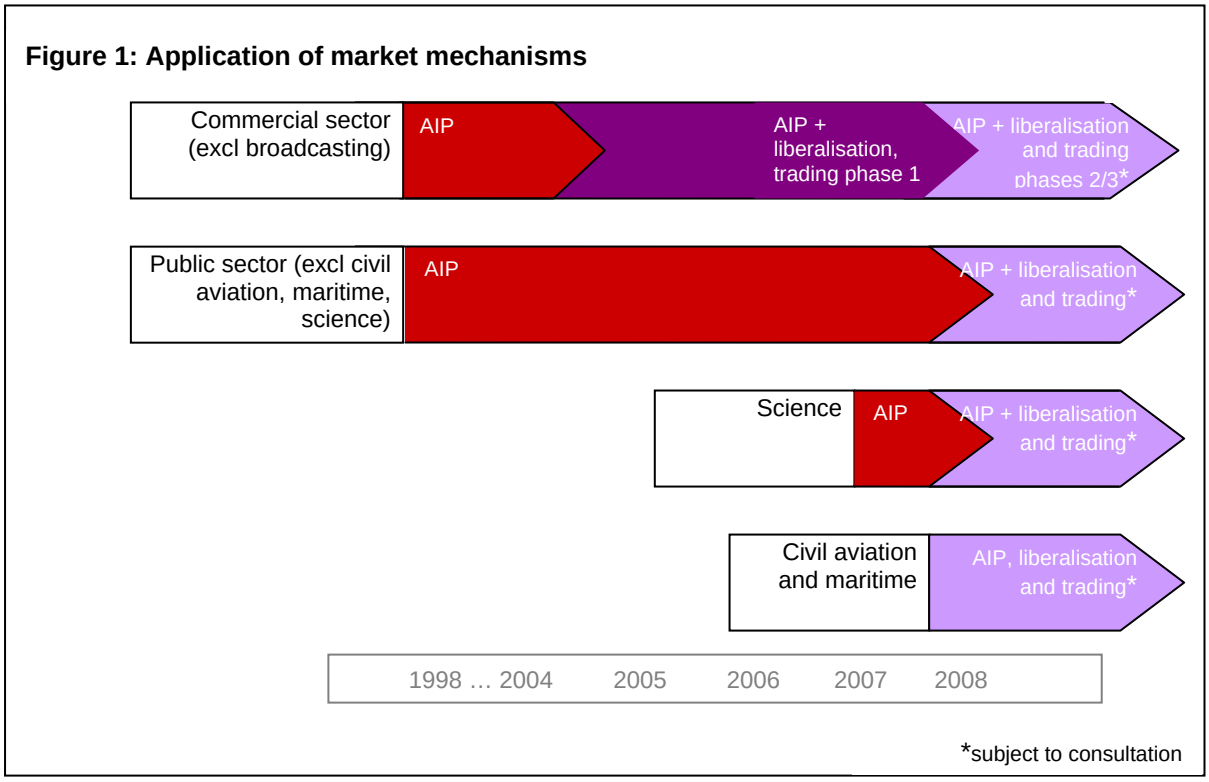
General approach to management of the radio spectrum

1.11 One of Ofcom's principal statutory duties is to secure optimal use of the radio spectrum to promote the interests of citizens and consumers. Ofcom considers that market mechanisms, such as trading, liberalisation, administered incentive pricing (AIP) and auctions are more likely to achieve this than 'command and control' methods based on regulatory and administrative decisions and has been applying and extending market mechanisms to spectrum use in the commercial sector.

Management of public sector spectrum holdings

1.12 The application of market mechanisms to public sector spectrum holdings has so far been limited. Government users, such as the MOD, emergency services and radio astronomy, pay an amount for spectrum that is comparable to the fees charged to commercial users for similar spectrum. However, public sector spectrum holdings are not tradable; and aviation and maritime spectrum licence fees are not based on incentive pricing. The Independent Audit recommended, and the Government and Ofcom agreed, that market mechanisms should be comprehensively extended to public sector spectrum holdings in line with Ofcom's general approach to spectrum management as illustrated in Figure 1 below, which is illustrative only as some elements are subject to consultation .

Figure 1: Application of market mechanisms



1.13 In this diagram, 'phase 1' trading and liberalisation refers to the initial selection of frequency bands commenced in December 2004 combined with liberalisation by individual licence variation; 'phase 2' refers to the extension of trading and introduction of more flexible licences in the Business Radio Sector; and 'phase 3' relates to the selective introduction of technology and application neutral licences, also known as 'Spectrum Usage Rights' ('SURs').

Recognised spectrum access

1.14 The extension of spectrum trading to public sector spectrum holdings that this document proposes would be facilitated by the selective introduction of recognised spectrum access (RSA). RSA is a relatively new spectrum management instrument that was introduced by the Communications Act 2003[6] (the 'Communications Act') and can be granted to persons or for uses of spectrum that do not require to be licensed under the Wireless Telegraphy Act 2006 (the 'WT Act'). Spectrum trading consists of the transfer of rights or obligations under a licence or RSA. Without RSA, Crown and certain other bodies that are not subject to licensing could not engage in spectrum trading. RSA would enable them to do so while also providing greater clarity and certainty about their rights and obligations in relation to spectrum.

The new framework

1.15 Spectrum trading and liberalisation are key components of the proposed new framework, supported by AIP and budgetary and operational targets for government departments. Ofcom considers that spectrum efficiency will be best promoted by enabling public sector spectrum holdings to be traded so that the bodies concerned can interact directly with the market instead of returning spectrum to Ofcom to award or being granted new assignments administratively.

1.16 This document proposes that we should start the introduction of these changes by applying them first to the 406.1 – 430 MHz, 2.7 – 3.4 GHz and 3.4 – 3.6 GHz bands. The precise timetable will depend on progress in resolving the matters referred to in paragraph 1.18 below.

1.17 This document discusses various issues. These include:

- the proposed approach of extending trading and RSA;
- how to introduce trading and RSA including whether to phase their introduction and the frequency bands likely to be of greatest interest to commercial operators;
- how public sector bodies can best engage with the market to release and share spectrum;
- some principles underlying the processes for award, trading and converting public sector spectrum licences and RSA.

1.18 Some complex issues will need to be resolved to apply the proposed new framework. This is partly because existing arrangements for using some of these bands rely on shared access by multiple public and private sector users. For example, the 2.9 – 3.1 GHz band is allocated jointly for defence, civil aeronautical and civil maritime use and the MOD, CAA and MCA each have an interest. Other bands are allocated exclusively to defence but the MOD has yet to finalise a detailed survey of its use that will enable it to assess the possibilities for release and sharing. Ofcom is actively supporting the MOD, CAA and MCA in this work.

1.19 The legislation is sufficiently flexible to accommodate various options and Ofcom expects to consult further when there is greater certainty on these matters.

[6] The relevant provisions are now contained in the Wireless Telegraphy Act 2006.

1.20 Meanwhile, Ofcom believes that this preliminary consultation will be of interest to a range of stakeholders in the public and commercial sectors and will enable them to express their views on the overall approach that is being proposed so that these can be taken into account in preparing detailed arrangements and regulations for further consultation.

1.21 Related initiatives that have been completed or are under way include:

- adoption of the presumption that public bodies will acquire spectrum through the market save in exceptional circumstances;
- introduction of RSA for radio astronomy;
- a substantial collaborative programme of work sponsored by Ofcom and with full participation by the MOD, CAA and MCA to define safety criteria for sharing in radar bands;
- consultation later this year on the application of AIP to selected frequency bands used for aeronautical and maritime applications;
- a detailed analysis by the MOD of its current and future expected spectrum requirements and publication in 2008 of its Military Spectrum Implementation Plan, which will identify opportunities to share or release spectrum and its plans for sharing or releasing its spectrum holdings to the market;
- a review by the CAA with the MOD and Ofcom of aeronautical navigation aids including radar and landing systems;
- formulation by autumn 2007 of options for the future management of spectrum used by the emergency services;
- setting specific and demanding targets for release of spectrum by government departments as part of the outcome of the comprehensive spending review (CSR).

Next steps

1.22 Following this consultation, Ofcom intends to issue a regulatory statement announcing its conclusions and consult further in greater detail. Subject to satisfactory progress of discussions between the public sector bodies concerned in defining their future spectrum management arrangements and spectrum requirements, Ofcom would expect to publish the further consultation by the end of 2007 and proceed during 2008 to implement any changes that it may decide to make following these consultations.

1.23 The implementation of any proposals to extend trading or RSA would require Ofcom to make various regulations, for example to specify the frequency bands in which they will be introduced and the possible procedures for trading and conversion. As required by section 122 of the WT Act, Ofcom would publish a Statutory Notice in advance of making these regulations, giving at least a month to comment.

Section 2

Introduction

The purpose of this document

2.1 This document consults on proposals for a new framework for management of public sector spectrum holdings in line with Ofcom's general approach to managing the radio spectrum[7]. Much of the detail of the proposed framework will depend on the outcome of ongoing discussions with and between the relevant public sector bodies about the future management of their spectrum holdings. Depending on the outcome of this consultation, Ofcom expects to publish a more detailed consultation later in the year when those discussions have progressed.

2.2 The objective of the proposed changes is to enhance the efficiency with which public sector spectrum holdings are used and, more specifically, to provide opportunities and incentives for public sector bodies to make spectrum available to other, including commercial, users. It aims to do this by extending to the public sector market mechanisms that Ofcom is progressively applying elsewhere to secure optimal use of the radio spectrum.

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 undertook a review of 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 supported by Ofcom. Further information about the Independent Audit is given in the next section. Full details, including the joint response by the Government and Ofcom and reports on progress, may be found at www.spectrumaudit.org.uk.

Some definitional notes

Public sector

2.4 In this document, unless the context otherwise requires, the term "public sector spectrum holdings" includes spectrum allocated to or managed by various government or public sector bodies and used for defence, aviation (civil and military), shipping (civil and military), science services and public safety services. This follows the terminology adopted by the Independent Audit. Ofcom recognises that civil aeronautical and maritime spectrum users are predominantly private sector but they are nonetheless included in the scope of this document because they were covered by the Independent Audit as part of the 'public sector'. In regulatory terms, these users come under the aegis of the CAA and MCA and the spectrum they use is mainly allocated to the MOD and CAA in the UK Frequency Allocation Table (UKFAT)[8].

Spectrum trading

2.5 One of the key themes of the proposals is the application of spectrum trading in the public sector. Spectrum trading involves the transfer of rights and obligations relating

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

to spectrum holdings in accordance with regulations made by Ofcom. There are various ways (or 'modes') in which spectrum can be traded. These are summarised in Annex 6. Spectrum trading can be temporary, in which case the spectrum holding reverts to the transferor after a specified period of time (sometimes referred to as 'leasing'), or permanent ('disposal') and can involve the entire spectrum holding or part of it sub-divided by frequency, geographical coverage or time, (referred to as 'sharing'). The term "spectrum trading" is generic and encompasses all of these. The modes of trading that are allowed will be specified by Ofcom in trading regulations but, within the scope of these regulations, it will be for the transferor to decide what form a particular transaction will take.

Spectrum holdings

2.6 "Spectrum holding" is used as a generic term to encompass spectrum use identified in either a licence or, potentially, in a grant of RSA. Although the emphasis of the Independent Audit and *Forward Look* is on spectrum release or sharing by the public sector, it is envisaged that similar processes would apply in reverse where public sector bodies seek to add to their holdings through the market.

Spectrum Usage Rights

2.7 There are references in this document to "Spectrum Usage Rights" (SURs). SURs are a way of specifying the technical terms and conditions of a spectrum licence or RSA in a way that is technology and application neutral.

The structure of this document

2.8 The rest of this document is arranged as follows.

- Section 3 – the spectrum management context
- Section 4 – mechanisms for promoting release and sharing of public sector spectrum holdings
- Section 5 – public sector RSA
- Section 6 – proposed introduction of public sector spectrum trading and RSA
- Section 7 – some principles underlying the trading and conversion processes
- Annexes 1 to 3 - Ofcom's consultation principles and how to respond to this consultation
- Annex 4 - the consultation questions
- Annex 5 – preliminary Impact Assessment
- Annex 6 - spectrum trading modes
- Annex 7 – glossary

Section 3

The spectrum management context

Introduction

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

The importance of radio spectrum

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 and science. Wireless technology is increasing in importance to meet rising demand for communication and entertainment while on the move. The importance of radio spectrum can be gauged from the fact that it has been estimated that its use underpins 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[9] and is likely to be an underestimate as it does not take into account the use of spectrum for commercial aviation, public safety, defence or science purposes.

3.3 Spectrum below 15 GHz is usually regarded as constituting the most useful and valuable part of the radio spectrum as 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 sufficient distances to make it commercially feasible to roll out national networks. Demand for spectrum at these frequencies is growing and it is critical for innovation and growth that they are used as efficiently as possible. Although valuing spectrum is difficult given the early stage of development of the spectrum market and depends on various factors, including the characteristics of the frequencies in question and past market developments and regulatory decisions, 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.

3.4 A study carried out for the Independent Audit by Analysys and Mason[10] 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".

Spectrum use in the public sector

3.5 Public sector spectrum holdings are used for a wide variety of applications including defence and emergency service radio communications, aeronautical and maritime

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

radar, meteorology and radio astronomy. These holdings account for nearly half of all radio spectrum and a similar proportion of frequencies below 15 GHz.

3.6 Given the continued increasing demand for spectrum and the magnitude of spectrum involved, it is important to ensure that this spectrum is used as efficiently as possible and to make the most of opportunities for commercial users to access it. Failure to do so risks depriving commercial users of access to spectrum and holding back innovation, competition and growth in wireless services to the detriment of citizens, consumers and businesses. Such opportunities should not, however, come at the expense of unacceptable effects on national security, operational effectiveness of essential services or public safety.

3.7 The charts below show the weighted[11] 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 sizable allocations to the civil aeronautical and maritime sectors and emergency services.

Figure 2: Weighted use of the spectrum

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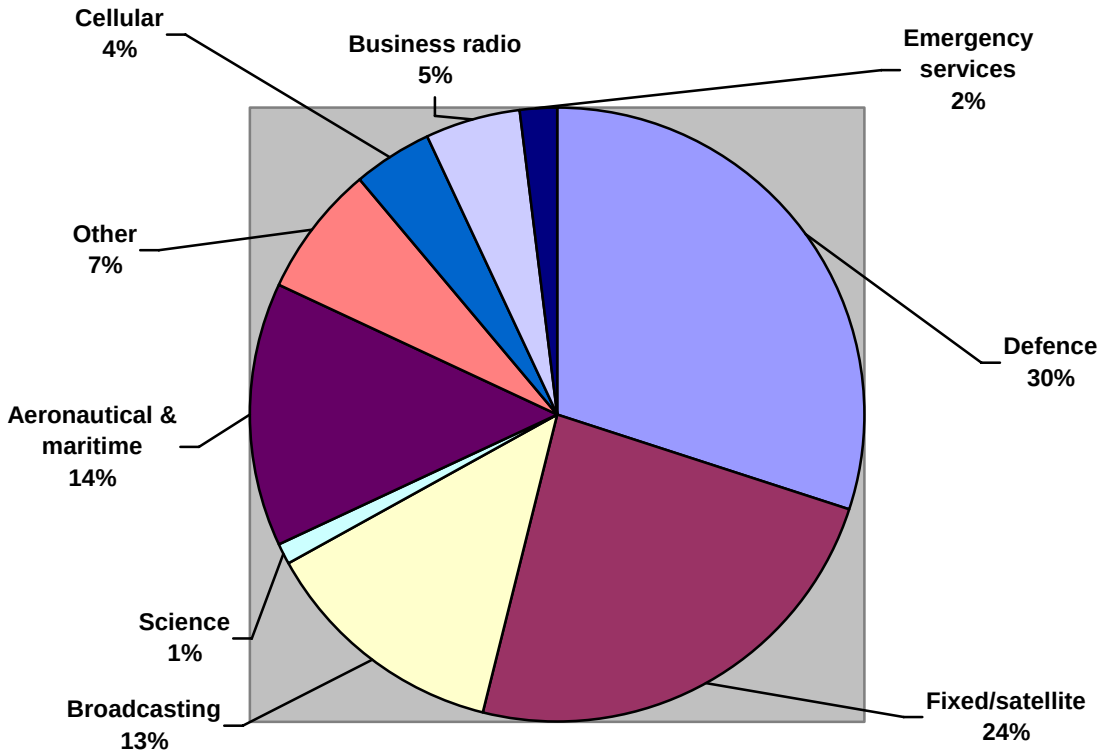

[11] Figures are weighted such that a 1 MHz allocation at 100 MHz is given equal weight to a 10 MHz allocation at 1 GHz.

Figure 3: Composition of public sector spectrum holdings below 15 GHz

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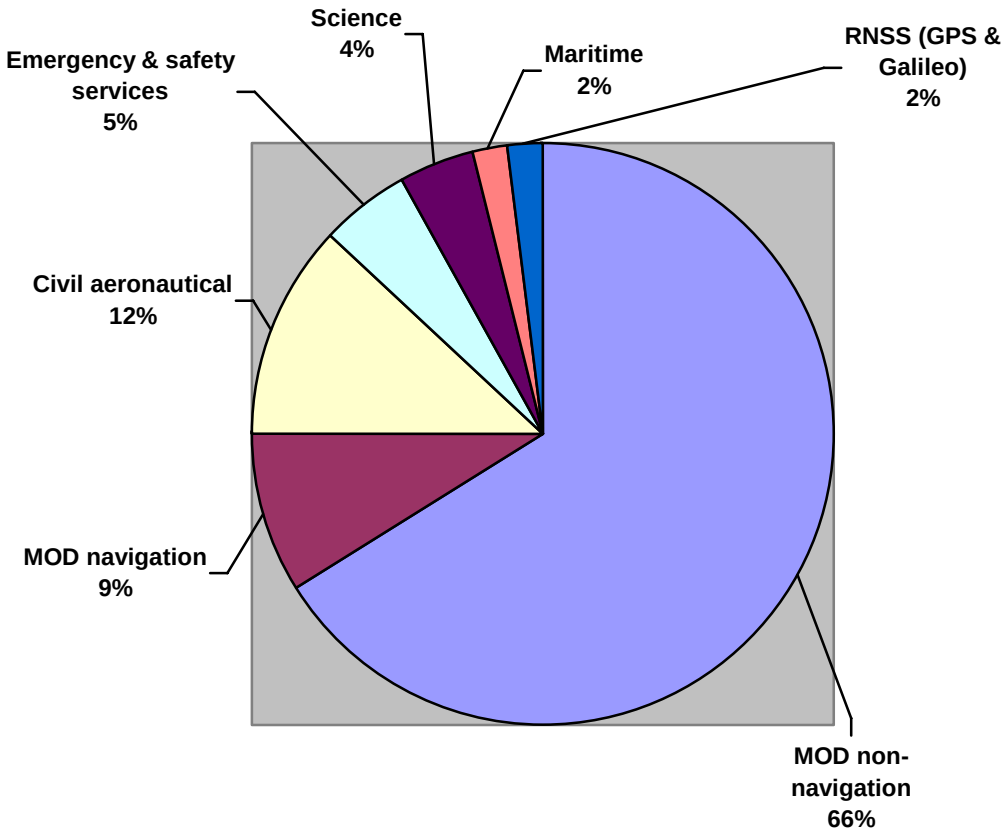

Source: Independent Audit of Spectrum Holdings

Ofcom's statutory functions and its approach to managing spectrum

3.8 Ofcom manages the radio spectrum within a statutory framework created by the Communications Act and the WT Act. These Acts set out Ofcom's functions, duties and powers. In particular[12], Ofcom has 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 in particular to the desirability of promoting its efficient management and use, economic and other benefits, innovation and competition. This, together with Ofcom's other duties, requires it to balance a range of considerations. Ofcom has a variety of regulatory tools and market mechanisms[13] at its disposal to manage the radio spectrum and uses these to carry out its functions.

3.9 Under the WT Act, it is an offence to install or use radio equipment without authorisation from Ofcom[14]. This requirement is imposed because, without careful

[12] This is a condensed account, not a comprehensive description of the legislative framework.
[13] An umbrella term used to encompass the application of market forces through spectrum pricing, auctions, liberalisation and trading.
[14] This requirement originated in the Wireless Telegraphy Act 1904 and was carried over into the Wireless Telegraphy Act 1949. The WT Act 2006 is a consolidation measure that combined several pre-existing statutes, including the 1949 Act, without substantive change.

planning and management, neighbouring transmitters that are not adequately separated geographically or by frequency are likely to interfere with each other greatly impairing the value of the airwaves as a communications medium and detracting from its optimal use. A prime aim of Ofcom's spectrum management policy is therefore to minimise the risk of unacceptable levels of interference. However, the WT Act does not bind the Crown so Crown bodies do not require authorisation by way of a licence in order to use spectrum; other arrangements are in place to plan and manage the spectrum that they use.

3.10 Radio equipment may either be individually licensed or exempted from the need for a licence by regulations made by Ofcom. Ofcom must exempt equipment that is unlikely to cause harmful interference[15].

3.11 Ofcom considers that, in most cases, optimal use of the radio spectrum is better secured through market mechanisms, than by 'command and control' regulation. Market mechanisms enable choices about how spectrum is utilised to be made by those, whether in the public or the private sector, who are directly involved in using it instead of being dictated by the regulator, who is likely to have less complete and up to date information about the value of alternative uses. Ofcom has published a number of documents giving the rationale for this view, in particular its *Spectrum Framework Review*[16].

3.12 The spectrum management reforms Ofcom is pursuing involve:

- using **auctions** to assign spectrum to those who can use it best and **AIP** to ensure that licence fees, by reflecting the value of the spectrum, provide incentives to use it efficiently;

- enabling **spectrum trading**[17] to take place in accordance with regulations made by Ofcom[18] so that spectrum rights can be transferred to those who can use them best; and

- **spectrum liberalisation**[19], 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. It is proceeding in stages from individual licence variation ('phase 1') through making licences more generically flexible[20] ('phase 2') to selective introduction of fully flexible spectrum usage rights (SURs)[21] ('phase 3').

3.13 This document concerns proposals to extend spectrum trading and liberalisation to public sector spectrum holdings. *Spectrum trading* provides a mechanism and incentive for those who hold spectrum to transfer it to others who can create greater value from it and are willing to pay an amount that exceeds its worth to the incumbent. *Liberalisation*, by removing restrictions on the way spectrum is used, enables users themselves, who are better placed than the regulator to do so, to select the application and technology that will generate the greatest value[22].

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[15] Section 8(4) of the WT Act
[16] http://www.ofcom.org.uk/consult/condocs/sfr/
[17] http://www.ofcom.org.uk/consult/condocs/spec_trad/
[18] Section 30 of the WT Act
[19] http://www.ofcom.org.uk/consult/condocs/liberalisation/
[20] http://www.ofcom.org.uk/consult/condocs/sur/
[21] SURs are an alternative way of expressing licence terms and conditions to be technology and application neutral. See http://www.ofcom.org.uk/consult/condocs/brtrading/
[22] See http://www.ofcom.org.uk/consult/condocs/liberalisation/.

Together, trading and liberalisation facilitate and promote the socially optimal allocation of the spectrum resource. Ofcom agrees with the Audit that their application to the public sector would be effective and beneficial.

Spectrum management roles

3.14 Ofcom's activities in carrying out its spectrum management duties and functions include:

- making spectrum available for different applications or services;
- planning non-military spectrum usage so that transmitters are sufficiently separated in terms of geographical location, frequency and time 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;
- representing the UK internationally;
- investigating interference and taking enforcement action against unauthorised use of spectrum.

3.15 This document focuses on the first five of the above activities.

3.16 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 (DBERR – 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 Executive, the Department of Trade, Industry and Investment Northern Ireland, the Meteorological Office, the MCA, Ofcom, the CAA and the National Policing Improvement Agency (NPIA).

3.17 With one exception[23], the only body that has power to grant spectrum licences in the UK is Ofcom; and only Ofcom 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.

[23] 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.

Defence

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

Civil aviation

3.19 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[24].

Civil maritime

3.20 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 licences.

Emergency and public safety services

3.21 Emergency and public safety services (E&PSS) comprise police, fire and ambulance services, 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). The services 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 the DBERR, 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 Ofcom; those that are Crown bodies do not require WT licences. 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

3.22 Radio astronomy is a passive (receive-only) service that is exempted from the requirement to be licensed as such use does not cause harmful interference to other services[25]. RSA has recently been introduced for radio astronomy and is currently

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

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

being applied for by the Science and Technology Facilities Council (STFC)[26], which is not a Crown body.

3.23 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)
MCA	No	No	No	No	No	Yes
PSSPG	No	Yes	Yes	No	No	No – spectrum used by emergency services, most of which are licensed bodies
STFC	No	No	Yes	No	No	Yes

The Independent Audit

3.24 In his pre-Budget report of 2004, 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 tasked with concentrating on frequencies up to 15 GHz.

The report of the Independent Audit

3.25 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.

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

3.26 Because Government departments are not licensed by Ofcom with respect to their spectrum use, there is at present no trading mechanism to allow or incentivise them to transfer spectrum to those who can use it to generate greater benefits. 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, the details are not specified or documented and rest on informal sharing arrangements. These two factors – the non-availability of a trading mechanism and lack of precise definitions of usage rights - constitute real barriers to making the best possible use of the spectrum.

3.27 The Independent Audit concluded that this is not a satisfactory basis for the future management of such a valuable resource and that putting in place mechanisms to facilitate spectrum trading would overcome the obstacles identified in the preceding paragraph and bring substantial gains for citizens and consumers.

The response to the Independent Audit

3.28 The Government's response to the Independent Audit, which was prepared in consultation with Ofcom and published in March 2006, agreed with the Audit's analysis, accepted its recommendations and committed to an action plan to implement them. The Government reported on progress in December 2006 and in March 2007 in its *Forward Look*[27].

3.29 In particular, the Government stated its support for extending spectrum trading to the public sector. The underlying principle is the same as applies to other assets and resources, for example land, buildings, energy or vehicles, used by the public sector. These are acquired at the market rate in quantities sufficient to deliver the service that is required, managed in order to use them as efficiently as possible and disposed of through the market if surplus to requirement. Although spectrum differs in certain respects from these other assets and resources, for example in the propensity of transmissions to cause and suffer interference, there is no reason in principle why the spectrum that public sector bodies use should not also be acquired and disposed of through the market.

3.30 Use of spectrum by the public sector imposes a cost in that it is denied to alternative uses or users. Spectrum trading combined with liberalisation provides an incentive to use spectrum more efficiently through the provision of price signals and market information about the real costs to the economy of using spectrum for one purpose rather than another and a mechanism to transfer spectrum to users and applications that can generate greater benefits.

3.31 There is already evidence that the current application of AIP has incentivised releases of spectrum, including in the public sector. It is difficult to be definite about the factors that lead to 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.

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

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	Remove constraints on active services 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	Remove constraints on active services at 10.6-10.68 MHz	80 MHz	2007
Radio astronomy	Remove constraints on active services at 31.5-31.8 MHz	300 MHz	2007
Police in Scotland	Release of non-contiguous spectrum in 450-462.5 MHz range	1 MHz	2007

3.32 The introduction of spectrum trading would reinforce the incentives for spectrum release and sharing and can be expected to lead to additional gains.

3.33 The Audit also recommended (recommendation 2.4) that income from spectrum trading, including short-term leasing and sharing, should be retained by departments subject to capping arrangements. In its response, the Government agreed that, for the incentives of trading to have the desired effect, public sector bodies should be able to benefit financially from sharing or release of spectrum and undertook that this will be discussed in the 2007 Comprehensive Spending Review (CSR) with the aim of providing “effective and proper incentives”.

3.34 Ofcom strongly supports the approach advocated by the Independent Audit and is committed to taking the necessary steps to provide a framework within which it can be implemented. The introduction of spectrum trading as proposed in this document is a key element of this.

Next steps

3.35 The proposed new approach to managing public sector spectrum holdings would represent a significant development in spectrum policy. Ofcom believes that it will be of interest not only to public sector spectrum users but also to commercial and other users who are interested in gaining access to those holdings.

3.36 The extension of spectrum trading to public sector spectrum holdings, facilitated by RSA, would require Ofcom to make regulations, for example to specify the frequency bands in which trading and RSA will be introduced as well as various ancillary regulations. As required by section 122 of the WT Act, Ofcom would publish a Statutory Notice in advance of making the regulations, giving at least a month to comment.

3.37 Subject to the outcome of this consultation and making the necessary regulations, Ofcom would expect to begin introducing the changes during 2008. The timing of any proposals will, however, depend on progress by public sector spectrum users, including Government departments and executive agencies, on formulating and agreeing arrangements for the future management of their spectrum holdings and in preparing to implement these proposals.

Related initiatives

3.38 As reported in full in the *Forward Look* publication referenced above, the proposals in this document constitute one element of the overall implementation programme adopted by the Government following the Independent Audit. Other initiatives that have been completed or are under way 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;
- a substantial collaborative programme of work sponsored by Ofcom and supported by the MOD, CAA and MCA to define safety criteria for different wireless communications systems and technologies to share spectrum in radar bands[28]. This includes pioneering technical trials at Oban and Loch Ewe that have yielded useful data to progress this work;
- consultation later in the year on extending AIP to selected frequency bands used for aeronautical and maritime applications (see below) to be followed by a more general review in the next financial year of AIP, which will affect the charges paid by Crown and other public sector bodies;
- adoption of specific and demanding targets for release of spectrum by departments as part of the outcome of the CSR;
- changes to the way in which Government departments and other public sector bodies manage radio spectrum, for example establishment of the Spectrum Acquisition Authority by the MOD, the Radar Group (comprising the MOD, CAA and MCA) and the Public Spectrum Safety Test Group (PSSTG);
- a detailed demand study by MOD of current and anticipated military spectrum requirements to ensure that the needs of national security and safety remain paramount and publication planned for 2008 of a Military Spectrum Implementation Plan that will identify opportunities to share spectrum with, or release it to, other, including commercial, users and how its spectrum holdings will be shared or released to the market;

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

- 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 that is currently considering 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 is committed to reporting by autumn 2007 to the UKSSC with proposals with firm options and resource requirements 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

3.39 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. The Independent Audit recommended that AIP should be extended to those sectors and Ofcom intends to consult on this later in 2007 following pre-consultation discussion with stakeholders that is now under way. Ofcom recognises that there is a linkage between decisions on AIP and those on trading and will take this into consideration at the appropriate stage. However, in Ofcom's view, the issues raised by the proposals in this document are sufficiently substantial and distinct from those raised by the proposed extension of AIP to make it worthwhile holding separate consultations.

Summary

3.40 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

Mechanisms for promoting release and sharing of public sector spectrum holdings

4.1 This section discusses Ofcom's initial thinking on options for enabling and incentivising release and sharing of public sector spectrum holdings.

4.2 Some complex issues will need to be resolved to apply the proposed new framework. This is partly because existing arrangements for using some of these bands rely on shared access by multiple public and private sector users. For example, the 2.9 – 3.1 GHz band is allocated jointly for defence, civil aeronautical and civil maritime use and the MOD, CAA and MCA each have an interest. Other bands are allocated exclusively to defence but the MOD has yet to finalise its detailed survey of its use that will enable it to assess the possibilities for release and sharing and expects to publish its Military Spectrum Implementation Plan in spring 2008. Ofcom is actively supporting the MOD, CAA and MCA in this work.

4.3 The legislation is sufficiently flexible to accommodate various options and Ofcom expects to consult further in greater detail when there is greater certainty on these matters. Subject to satisfactory progress, Ofcom would hope to be able to do this later in 2007.

Mechanisms for releasing or sharing spectrum

4.4 Spectrum trading has not yet been applied in relation to public sector spectrum holdings. So, while AIP provides an inducement for public sector bodies to reduce costs by releasing spectrum, the additional incentive of being able to realise gains from trading is absent. The proposals in this document aim to enable public sector bodies to engage in spectrum trading and so to reinforce the incentives for spectrum efficiency in the interests of securing optimal use of the radio spectrum.

4.5 Where a public sector user has identified an opportunity to release or share spectrum with commercial users (referred to in the Independent Audit as 'band sharing'), it has returned spectrum to Ofcom (or its predecessor) to award or assign. This mechanism relies primarily on the public sector body or Ofcom identifying opportunities for band sharing and channelling all releases through Ofcom rather than allowing public sector users to engage directly with the market themselves. Where a public sector body identified a need for additional spectrum, Ofcom assigned spectrum administratively. This raises the question discussed in following paragraphs of whether the process would be more effective, efficient and dynamically responsive if public sector spectrum users could engage directly with the market in the same way as users in the commercial sector where trading has been introduced.

Direct release by public sector bodies is preferable

4.6 The Independent Audit concluded that indirect engagement with the market - returning spectrum to Ofcom - is likely to be less effective than direct engagement in terms of securing optimal use of the spectrum. Ofcom sees the following advantages in direct engagement with the market by public sector bodies.

- More opportunities to access spectrum: if a public sector body can benefit financially from trading, it has a greater incentive to release or share spectrum than if its gain was limited to a reduction in the AIP it pays. It might also be more willing to share or release the spectrum as 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 would provide an alternative source of supply and provide businesses with alternatives to securing spectrum access from Ofcom or through spectrum trading with another licensee. This is likely to promote the development of the spectrum market and enhance spectrum efficiency.

- 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 compare the processes for direct and indirect sharing and release. It can be seen that the direct process is far simpler and can be expected to be substantially faster.

Figure 4: Indirect release (the status quo)

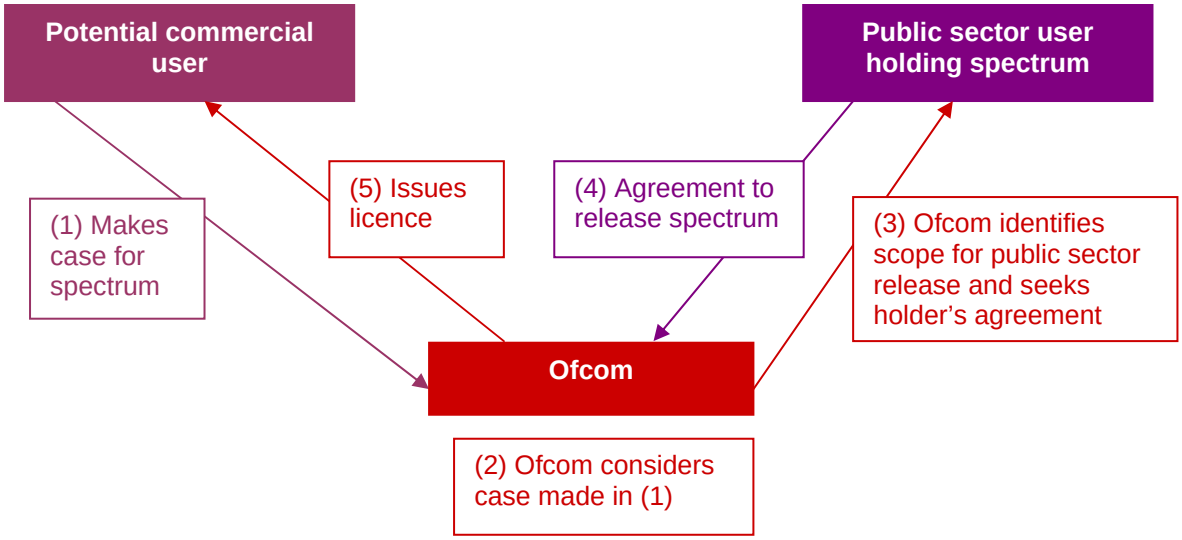
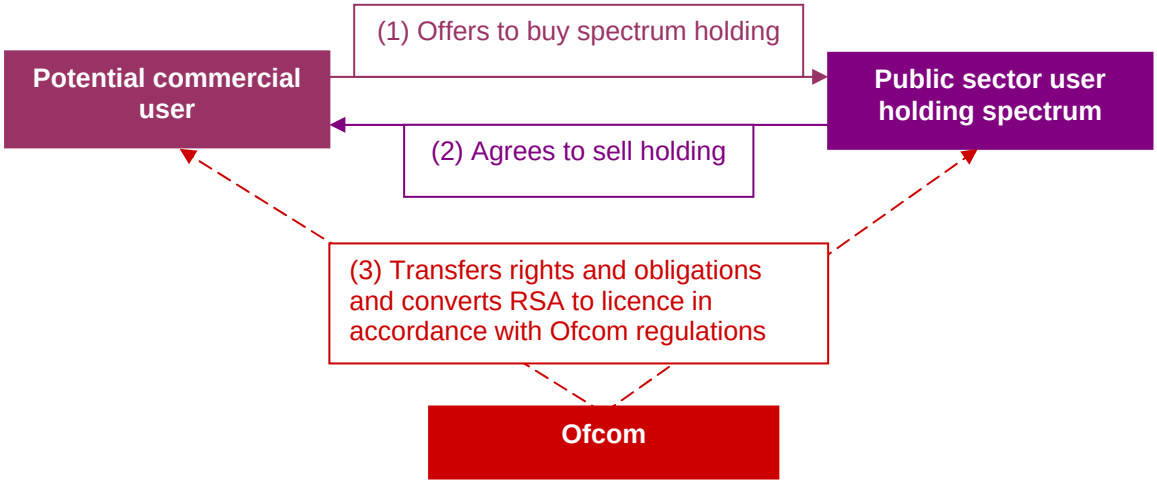


Figure 5: The proposed new framework



4.7 Based on the above analysis, Ofcom is minded to conclude that direct release by public sector bodies is in general likely to be preferable. However, there might be circumstances in which indirect release to the market through Ofcom would be 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 direct spectrum release or sharing is generally the preferred option.

Ofcom's role

4.8 In order to realise the benefits of direct release or sharing discussed in preceding paragraphs, public sector bodies that hold spectrum need to have available the expertise to manage their holdings effectively as well as effective financial incentives. Building the requisite spectrum management capability might take some time. In the meanwhile, Ofcom will continue to advise and assist public sector bodies on how best to release or share spectrum holdings to achieve maximum benefits for citizens and consumers and on the implications of international harmonisation[29] and standardisation[30] developments and international obligations.

4.9 Ofcom is also working with spectrum-holding public sector bodies to develop practical arrangements to take full advantage of the opportunities presented by the Independent Audit's recommendations and to develop a framework that would meet their needs and achieve the overall aim of enhancing spectrum efficiency and promoting opportunities for spectrum release and sharing within the statutory provisions of the 2003 and WT Acts.

Safeguarding public safety and health and national security

4.10 Many public sector spectrum holdings are used for purposes related to national security, public safety or health. Concerns have been expressed that release of public sector spectrum holdings could, in some circumstances, affect public safety or national security. 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.

[29] Harmonisation is the identification of common frequency bands throughout a region (eg Europe) for a particular application and, in some cases, technology.
[30] Development of an open standard for a particular type of equipment

4.11 The framework proposed in this consultation includes a number of features to ensure that public safety and national security will not be unacceptably affected by releases of spectrum by public sector bodies.

- Bodies such as the MOD, CAA, MCA, NPIA, DoH and DCLG have specific responsibilities and expertise in relation to these matters. They or their client organisations will be able to decide whether or not to release spectrum, the amount and timing of releases and the conditions that need to be applied to safeguard essential operations.

- Ofcom will be responsible for granting wireless telegraphy licences to incoming commercial users and will apply safety criteria being developed by the CAA and MCA to ensure through appropriate RSA and licence conditions that sharing with other services does not cause excessive interference to radar operation. The CAA and MCA will carry out rigorous safety assessments of individual proposals in bands allocated to civil aeronautical and maritime use and advise Ofcom as necessary.

- Ultimately, the Secretary of State has powers of direction over Ofcom in relation to national security, public safety and public health[31].

Ensuring effective competition

4.12 There is potential for individual spectrum trades to lead to a distortion of competition. Allowing companies to purchase more spectrum, whether from private or public sector bodies, could lead to the acquisition of market power both in the market for a particular type of spectrum, or in a related downstream market (ie a market, like mobile telephony, to which spectrum is an input). Such market power could then result in distortions of competition, for example in the following ways.

- Companies could limit competition in downstream markets by purchasing spectrum which forms an essential input to the downstream market and then preventing competitors from accessing it.

- Companies could obtain control of a large proportion of the spectrum necessary for a particular service. They could then seek to distort competition in other related markets by requiring customers to purchase additional products sold by the company when they purchase access to the spectrum. For example, a company holding a large proportion of particular spectrum could force customers to purchase transmission equipment from them along with access to the spectrum.

- Intermediaries could dominate access to particular spectrum bands and may then be able to charge excessive prices for access to the spectrum that they control. Users could be forced to pay the excessive prices because their transmission equipment works only on the frequencies controlled by the intermediary.

4.13 Ofcom has previously considered in depth 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 it is keeping this conclusion under review. Ofcom's reasoning is set out in detail in the consultation and statement on ensuring effective competition in spectrum trading[32].

[31] Section 5 of the Communications Act 2003
[32] http://www.ofcom.org.uk/consult/condocs/sec/statement/statement.pdf

Ofcom sees no reason why this conclusion should not also hold in relation to trading of public sector spectrum holdings and will stand ready to advise pubic sector bodies that are considering releasing or sharing spectrum on how to do so in a way that promotes competition.

Summary

4.14 This section has considered how spectrum trading could promote release and sharing of public sector spectrum holdings while maintaining public safety and national security and ensuring effective competition. It concludes that direct disposal through trading by public sector bodies is likely to be preferable to indirect release via an Ofcom award. Discussions with the public sector bodies concerned about future spectrum management arrangements are ongoing and, subject to the outcome of this consultation, Ofcom will consult further on the details of the regulatory framework that would be put in place to give effect to any changes. These would include effective processes to maintain national security, public safety and effective competition.

Question 1: do you agree with Ofcom's proposed overall approach to improving the management of public sector spectrum holdings and, in particular, with Ofcom's conclusion that it will generally be preferable for public sector bodies to interact directly with the market?

Question 2: what factors do you consider Ofcom should take into account in determining the programme of reform in the framework for managing public sector spectrum holdings?

4.15 The following section describes RSA and its potential application in the public sector.

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[33] 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[34]; as a result, there is no formal recognition akin to that conferred by a licence of their use. Hence 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 certain public sector spectrum holdings in the shape 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 applying market mechanisms more widely to public sector spectrum holdings in line with the Independent Audit implementation plan.

What is RSA?

5.4 RSA is a relatively new 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.
- 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.

[33] 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.
[34] 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[35].

- RSA, may be made tradable and may be converted into a licence, for example where it has been traded to a non-Crown body, in accordance with regulations made by Ofcom[36].

- RSA may be granted by an auction process or on a 'first come – first served' basis and charged for on the basis of administered incentive pricing (AIP)[37]. Ofcom cannot require the Crown to pay AIP but the Secretary of State may make payments to Ofcom in respect of the use of spectrum by Crown bodies[38] in line with the Government's policy, reaffirmed in the response to the Audit, that the public sector should 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' use and reception (without transmission) as 'passive'. The WT Act requires installation or use of radio equipment to be authorised by Ofcom. Authorisation is achieved either by an individual licence or by general exemption regulations.

5.7 The WT Act does not bind the Crown so Crown bodies (eg government departments and executive agencies) do not need authorisation from Ofcom in order to install or use radio equipment and there is no basis for Ofcom to license them. Nor is licensing required for operators of passive services, such as radio astronomy. RSA provides an alternative form of spectrum holding that may be granted in such cases.

5.8 This document concerns two categories of public sector spectrum use that cannot be licensed by Ofcom:

i) transmission or reception by Crown bodies;

ii) operation of licence-exempt receive-only equipment by non-Crown public bodies. Ofcom has already introduced RSA for radio astronomy but has deferred making this tradable until the Government clarifies how the proceeds would be treated.

5.9 The following table illustrates the applicability of licences and RSA in the public sector depending on whether use is active (involving transmission) or passive (receive-only).

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

Table 5.1: Application of licences and potential application of RSA in the public sector

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	–	√

What the Independent Audit and the response said about RSA

5.10 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 responses, are relevant.

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

> "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.
>
> 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

"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.

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."

Advantages of RSA for public sector spectrum holdings

5.11 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 Wireless Telegraphy Act 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.

- Subject to the Government's conclusions on the treatment of the proceeds, public sector users will potentially 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[39]. 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

5.12 This section has explained the concept of RSA for public sector spectrum holdings and its potential advantages when combined with market mechanisms. The following section discusses various issues relating to the proposed introduction of spectrum trading and RSA for public sector spectrum holdings.

[39] Under section 31 of the WT Act

Section 6

Proposed introduction of public sector spectrum trading and RSA

Introduction

6.1 This section discusses various 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.

Should introduction of public sector spectrum trading and RSA be phased?

6.2 In introducing spectrum trading and RSA for public sector spectrum holdings, it is necessary to consider whether Ofcom should introduce these measures across all such holdings in one step or roll them out progressively starting with frequency bands considered to be of higher priority.

6.3 Introducing spectrum trading and RSA in one step for all public sector holdings would provide flexibility across a wide range of frequencies without the need for Ofcom to make further regulations. It would allow public sector bodies to engage in trading but would not compel them to do so. It is arguable that this could be advantageous in view of the rate and unpredictability of change in electronic communications. If RSA and trading were introduced selectively 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

6.4 On the other hand, the changes recommended by the Independent Audit and the proposals in this document mark a considerable shift in the way in which public sector bodies manage spectrum holdings; and the 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 is minded to agree with the Audit and response that it would be prudent to phase in the changes so that experience can be gained of how they operate in practice before extending them more widely. This would be consistent with Ofcom's general approach to the introduction of spectrum trading and liberalisation. Ofcom is therefore inclined on balance to favour a phased approach.

Selection of frequency bands for first introduction

6.5 If a phased approach is adopted, it will be necessary to select the frequency bands for initial application of the proposals. As discussed by the Independent Audit, it would seem sensible to make this selection on the basis of the expected gains and the practical complexity of implementation. 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 characteristics of the frequency band in question that affect its attractiveness to commercial operators. These are discussed in the following paragraphs.

The needs of public sector users

6.6 Decisions on spectrum release will be driven by the public sector bodies concerned. They will need to consider how much spectrum they need to meet their operational requirements and public policy goals, including public safety and national security, and judge the optimal mix of investment in more spectrum efficient equipment or alternative (non-wireless) technologies given 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 just as for other inputs that they require. They have not so far precisely quantified their future spectrum requirements but the *Forward Look* publication[40] provides an initial qualitative analysis.

6.7 The principal public sector user of spectrum is the MOD, which currently has management rights to, or a significant interest in, about a third of the spectrum below 15 GHz. The MOD, with support from Ofcom, is examining its use of its spectrum holdings to identify opportunities for release to the market.

6.8 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. However, a survey for the MOD by consultants QinetiQ[41] 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* and further clarification is expected as the MOD's detailed audit of its spectrum requirements progresses.

6.9 The MOD has said that it plans to publish a Military Spectrum Implementation Plan in spring 2008. This will set out its plans to release and share spectrum. Until then, it is not possible to say precisely which frequency bands might be released or shared with commercial operators. However, as detailed in the *Forward Look* publication, the MOD has initiated a programme of work to identify which spectrum can be released and when, including holdings at 406.1 – 430 MHz, 2.7 – 3.4 GHz and 3.4 – 3.6 GHz that have been identified as priority bands. Detailed audits are planned to be completed by summer 2007 for the 3.4 – 3.6 GHz band and by the end of the year for the 406. 1 – 430 MHz and 2.7 – 3.4 GHz bands. By May 2008, the MOD has said that it will have completed a database of spectrum use in all the bands identified by the Independent Audit. 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.

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

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 due to be completed summer 2007		3.4–3.6 GHz		
Detailed audit planned to be completed end 2007	406.1–430 MHz	2.7–3.4 GHz		
Detailed audit planned to be completed spring 2008	137–154 MHz 230–400 MHz 400.15–406.1 MHz 430-450 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 4.4–5.0 GHz 5.0-5.85 GHz 7.9–8.4 GHz 8.5–10.5 GHz	13.25–14.0 GHz 15.4-17.7 GHz

6.10 In the *Forward Look*, the Government committed to a programme to begin releasing military spectrum in 2008 with a "significant proportion" of the MOD's spectrum holdings to follow during 2009 and 2010 when the necessary audits have been completed.

6.11 In addition, the PSSPG is considering the scope for any release of bands below 470 MHz currently used by the E&PSS. The conclusions of this work together with the expected timetable are expected to be published by the end of 2007.

Demand from commercial services

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

6.13 The Independent Audit commissioned a study of spectrum demand for non-government services for 2005-2025[42]. 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.

6.14 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

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

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 will be discussed at the forthcoming World Radiocommunication Conference WRC-07 (agenda item 1.4 - see paragraph 6.26 below).

6.15 The consultants 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.

6.16 Ofcom acknowledges that detailed predictions of future demand for particular frequency bands are likely to be subject to uncertainty. Change is rapid and unpredictable and Ofcom is inclined not to place undue weight on such forecasts. However, based on the available evidence, it seems likely that frequencies below about 5 GHz will be particularly in demand for commercial exploitation and that there could also be shortages at those and higher frequencies.

Other characteristics of the spectrum

Current use of the band

6.17 The extent to which a band is jointly allocated to different public sector users or already shared with commercial operators may 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. The following table illustrates the current position for MOD spectrum holdings between 400 MHz and 5 GHz.

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
1215-1350 MHz	MOD/CAA	MOD/CAA/Ofcom	MOD/civil aviation/amateur/Earth exploration/space research
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

6.18 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 incumbent users, this will usually reduce the scope for sharing, though, there may also be an opportunity to coordinate better amongst existing users and so release spectrum. 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.

6.19 If RSA were to be introduced in bands in which there are incumbent users that are licensed by Ofcom, it would be necessary to define interfaces between them and the RSA to coordinate the various users of the band so that they can coexist without causing or suffering unacceptable levels of interference. In line with Ofcom's general approach to liberalisation, Ofcom envisages that the boundary conditions of the RSA would be set so as not to reduce the spectrum quality of incumbent users below their current spectrum quality, which is generally indicated by a spectrum quality benchmark (SQB)[43]. Ofcom would aim to maintain the spectrum quality that they experience at a level that is consistent with the relevant SQB although, for the reasons given on page 14 of the statement on spectrum liberalisation[44], this cannot be absolutely guaranteed. RSA for passive services would be designed to reflect existing assignment policies and to avoid imposing any new constraints on other services.

6.20 Further technical work is in hand by Ofcom, in conjunction with the MOD and other public bodies concerned, on how to formulate the way in which RSA will be

[43] 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.
[44] http://www.ofcom.org.uk/consult/condocs/liberalisation/

technically defined in frequency bands in which it is proposed to be introduced. The position of existing sharers in the bands would be addressed in a further consultation.

6.21 Ofcom is consulting separately[45] on spectrum access by the PMSE sector, principally in relation to the digital dividend (470-862 MHz) but with a view to the application of its proposals to other bands, including those shared with the MOD.

Size of holding

6.22 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 Ofcom's standard licences but do not confer formal recognition.

6.23 Ofcom considers that it would be less advantageous to introduce RSA in frequency bands managed by Ofcom as these assignments are already fully documented and it can be more efficient for such small-scale holdings such as individual fixed links to be returned to Ofcom for reassignment if they become surplus to a Crown body's 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

6.24 International harmonisation of spectrum use can take a number of forms. Provided harmonisation is sufficiently flexible, it can enhance the benefits from spectrum by providing opportunities to exploit inter-operability, cross-border roaming and economies of scale in equipment manufacture. Spectrum that is available internationally can be expected to offer attractive prospects for commercial operators. On the other hand, if a band is encumbered by rigid harmonisation restrictions, this will limit the alternative uses that can be made of it and can detract from the value of the band.

6.25 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.

6.26 Some of the frequency bands mentioned in this document and in which there are public sector spectrum holdings that might be released or shared are under consideration in the preparations for WRC-07 as candidate bands for future generations of mobile radio systems (described in the ITU as "IMT-Advanced"). The position the UK is taking in the preparations for WRC-07 on this issue is described in an Ofcom statement published on 7 June 2007[46]. That position takes into account the timescale for WRC-07 decisions, the current international climate and the nature of the relevant WRC agenda item. Irrespective of the outcome of WRC-07, there may be considerable scope for releasing spectrum at national level in the bands in question; and, 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, it

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

would be Ofcom's intention to present these internationally with a view to exploring the possibility of making the international frequency allocations more flexible.

Preliminary conclusions on phasing

6.27 Ofcom's initial view is that it would be preferable to phase in public sector spectrum trading and RSA beginning with major (ie national and regional) holdings that are likely to be attractive to commercial sharers. Such an approach would enable Ofcom and public sector bodies concerned to prioritise 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.

6.28 Based on the expected release and sharing intentions under consideration by the MOD and civil demand for spectrum identified by the demand study carried out for the Independent Audit, it seems to Ofcom that the frequency bands at 406.1 – 430 MHz, 2.7 - 3.4 GHz and 3.4 – 3.6 GHz offer realistic prospects of significant early gains from release or sharing. On that basis, Ofcom would propose to commence the phased introduction of the proposals in those bands.

6.29 Ofcom would welcome views both on the principle of phasing and the frequency bands that should be given priority if a phased approach is adopted.

Question 3: do you consider that the proposals should be phased in?

Question 4: do you agree with Ofcom's proposals about the frequency bands that offer the greatest potential benefits from band sharing? Are there other frequency bands where the facility to trade or lease spectrum from public sector bodies would be particularly attractive?

Technical specification of RSA and licences: maximising flexibility

6.30 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.

6.31 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).

6.32 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.

6.33 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.

6.34 It is not mandatory to hold RSA so terms and conditions in RSA would not limit the use that may be made of the spectrum in the way that licence terms and conditions do. Nonetheless, the Government has agreed that public sector users should observe the terms and conditions that are recognised by the RSA that they hold and Ofcom proposes to apply the same principles of liberalisation to RSA as to licences. This will simplify the process of converting RSA to licences and facilitate access by commercial sharers for a range of alternative services and technologies.

6.35 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. Detailed proposals will be published in due course.

6.36 It is also necessary to consider whether to make licences awarded to commercial operators of radar in bands such as 2.7 – 2.9 GHz technology and application neutral as well as tradable. The position is complex. 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. Because of the constraints, it is possible that there could be scope to increase spectrum efficiency by a centrally coordinated process to reorganise assignments and permit release of a contiguous block of spectrum. Ofcom will discuss this further with the MOD, CAA and MCA before deciding how to proceed.

Procedure for grants of RSA

Bodies with existing holdings

6.37 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.

6.38 Ofcom accordingly proposes that, once regulations had been made to introduce RSA in a band, an eligible public sector body with an existing holding that was not the subject of a WT licence could apply for a grant of RSA. Ofcom would expect to grant the RSA up to the limits of that holding. The terms and conditions of the grant would be agreed between Ofcom and the applicant. These would be set so as not to exceed the boundaries of the current holding and so as not to impose any additional constraints on licensees in neighbouring frequency bands or geographical areas. This is the approach that Ofcom adopted in relation to radio astronomy RSA.

[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.

6.39 Ofcom considers that this general approach is justified because grant of RSA in respect of existing holdings simply formalises existing use of the spectrum by the public sector body concerned and technical terms and conditions would be designed to maintain the spectrum quality of neighbouring assignments and to avoid imposing additional constraints on other services.

6.40 Ofcom would consider on a case-by-case basis whether it was necessary 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

6.41 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 from the private sector by the reverse of the process envisaged for release or sharing by the public sector or from another public sector body.

Question 5: do you agree with Ofcom's proposed approach to awarding public sector licences and RSA?

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

6.42 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[48]. It is envisaged that RSA, trading and conversion regulations would apply throughout the UK but it is also necessary to consider their application in the Crown dependencies of 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, as far as the Crown dependencies are concerned, unless the spectrum trading provisions are further extended to Jersey and the Isle of Man, public sector RSA could be introduced in the Channel Islands and the Isle of Man and made convertible into licences but could be tradable only in Guernsey.

6.43 The lack of opportunity for trading, which is an important part of the overall package for facilitating band sharing, makes it doubtful whether early application of RSA to the Isle of Man and Jersey would be worthwhile. It is more open whether to introduce tradable RSA in Guernsey. Relevant considerations include the extent of any Crown use of spectrum on Guernsey and opportunities for sharing there. Ofcom is inclined not to include the Channel Islands or Isle of Man in the scope of the changes initially but will discuss this further with the island administrations.

Question 6: should public sector spectrum trading be introduced at this stage in the Channel Islands and Isle of Man?

[48] 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)

Summary

6.44 This section has considered the process for introducing trading and initial grant of licences and RSA in public sector spectrum holdings. It discusses whether trading and RSA regulations should be phased in and suggests how phasing could be introduced if that approach is adopted, beginning with bands containing major public sector holdings that are attractive for commercial sharing and do not involve excessive complexity. It further proposes that initial grants of RSA to public sector bodies should be made administratively to reflect current spectrum holdings, should be made as technology and application neutral as possible and should not extend to the Channel Islands and Isle of Man.

6.45 The following section discusses various issues concerning the process for releasing and sharing public sector spectrum holdings through trading and conversion.

Section 7

Some principles underlying the trading and conversion processes

Introduction

7.1 This section discusses some principles relevant to the release and sharing of public sector spectrum holdings. This will involve 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 decide to adopt for managing their spectrum holdings, especially those shared by one or more public bodies. For that reason, it is not possible to specify at this stage exactly how they will work. Ofcom plans to consult in more detail once these discussions between the public bodies concerned have progressed further. The following paragraphs therefore provide an outline only.

Transfer of rights and obligations

7.4 Subject to the outcome of this and any further consultation, the trading regulations and processes already in place[49] for a range of WT Act licences might constitute a starting point for trading regulations for public sector spectrum holdings. The regulations might then 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 6.
- 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:
  - o without the consent of the current holder or holders;
  - o if sums are owing to Ofcom in respect of the holding;
  - o if Ofcom has given notice of variation or revocation;

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

  - without Ofcom's consent, which would normally be expected to be forthcoming;

  - 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 would 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).

- Ofcom does not at present charge for processing transactions in the commercial sector although this policy is kept under review and, in line with that, would not intend to do so in relation to transfers or conversion of public sector spectrum holdings, at least initially.

7.5 The current trading process, if extended to public sector spectrum holdings, would involve the surrender of the original RSA or licence and the making of fresh grants that reflect the terms and outcome of the transaction. This may be summarised as follows:

- The transferor and transferee agree the terms of the transfer, which is then notified to Ofcom for Ofcom to give its consent and issue amended licences or RSA to the parties in accordance with the terms of the transfer.

- Ofcom may withhold consent only in the circumstances set out in the trading regulations.

- The regulations specify the types of transfer that are permitted. Transfers may be total or partial and outright or concurrent. Annex 6 provides further details about these different types (or 'modes') of trading.

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

- Ofcom publishes certain information about licences in the WT Register and limited details about transfers in the Transfer Notification Register (TNR). Both registers are available on Ofcom's 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 made by Ofcom.

7.6 Further details of the current trading process may be found through Ofcom's spectrum licensing portal[50].

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

Grounds for withholding consent to a proposed trade

7.7 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. Ofcom's policy, which is in line with its regulatory principles and duty[51] to avoid imposing unnecessary regulatory burdens, is to keep the grounds on which it may block a trade to the minimum in order to provide commercial certainty and to avoid deterring or delaying transactions. It is for consideration whether the grounds should be similarly limited in the case of public sector spectrum holdings or whether the use to which certain holdings are put makes it necessary to allow additional grounds to refuse consent. For example, in some circumstances, release or sharing of spectrum holdings could affect air or maritime safety or the operational effectiveness of an emergency service.

7.8 In considering this, Ofcom is required to take account of the principles and duty mentioned in the preceding paragraph to ensure that its intervention is evidence-based, proportionate, consistent, accountable and transparent in both deliberation and outcome and is as unintrusive as possible to achieve its policy objectives. The key issue is whether there is sufficient need or justification for adding to the regulatory burden by introducing an additional ground for refusing consent. An important consideration is whether any risk to safety or operational effectiveness arising from a proposed transaction could be more effectively and appropriately dealt with by direct regulation, eg under the Air Navigation Order or merchant shipping regulations, or through administrative or statutory control by a government department, agency or regulator than by trading regulations under the WT Act. Ofcom will be discussing this further with the public bodies concerned but would meanwhile welcome views from stakeholders.

Question 7: should there be additional grounds, eg safety-related, for Ofcom to refuse consent to a proposed trade in certain frequency bands or for certain applications?

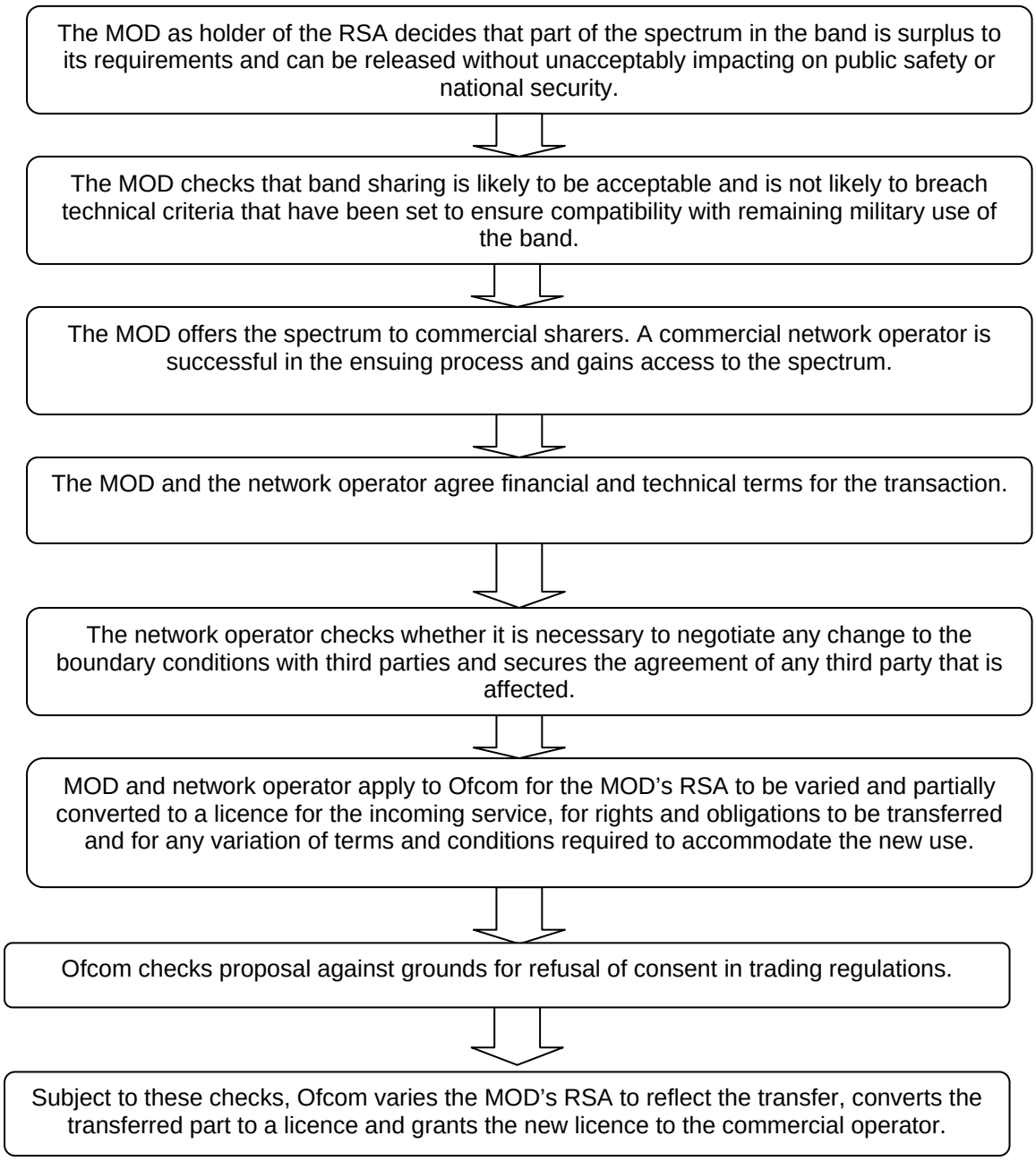
An illustrative example

7.9 The following flowchart 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 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.

7.10 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 precise arrangements entered into by the MOD and other public sector bodies.

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

Figure 6: Schematic spectrum release and sharing process



Conversion and change of use

7.11 Conversion of RSA into a licence and vice versa is a new procedure that has no parallel in current trading regulations or processes. Ofcom would intend to make the process as streamlined as possible in order to minimise regulatory burden, uncertainty and delay.

Information

7.12 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. Ofcom currently publishes information about grants of licences and RSA in the WT Register and about transfers of licences in the TNR. Both registers are published on Ofcom's website.

7.13 If RSA and spectrum trading were extended for public sector spectrum holdings, Ofcom would consult on arrangements to publish information about them and their transfers. In so doing, it would take account of the fact that there might be a need for certain sensitive information to be withheld for security reasons.

Annex 1

Responding to this consultation

How to respond

A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made **by 5pm on 4 October 2007**.

A1.2 Ofcom strongly prefers to receive responses using the online web form at http://www.ofcom.org.uk/consult/condocs/sfrps/howtorespond/form, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.

A1.3 For larger consultation responses - particularly those with supporting charts, tables or other data - please email laurence.green@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.

A1.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

Laurence Green
Floor 3
Spectrum Markets Team
Riverside House
2A Southwark Bridge Road
London SE1 9HA

Fax: 020 7981 3990

A1.5 Note that we do not need a hard copy in addition to an electronic version. Ofcom will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.

A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 4. It would also help if you can explain why you hold your views.

Further information

A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Laurence Green on 020 7783 4289.

Confidentiality

A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt (when respondents confirm on their response coversheet that this is acceptable).

A1.9 All comments will be treated as non-confidential unless respondents specify that part or all of the response is confidential and should not be disclosed. Please place any confidential parts of a response in a separate annex so that non-confidential parts may be published along with the respondent's identity.

A1.10 Ofcom reserves its power to disclose any information it receives where this is required to facilitate the carrying out of its statutory functions.

A1.11 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use in order to meet its legal requirements. Ofcom's approach on intellectual property rights is explained further on its website at http://www.ofcom.org.uk/about/accoun/disclaimer/

Next steps

A1.12 Following the end of the consultation period, Ofcom intends to publish a statement by the end of 2007.

A1.13 Please note that you can register to receive free mail Updates alerting you to the publications of relevant Ofcom documents. For more details please see: http://www.ofcom.org.uk/static/subscribe/select_list.htm

Ofcom's consultation processes

A1.14 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.

A1.15 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk . We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.

A1.16 If you would like to discuss these issues or Ofcom's consultation processes more generally you can alternatively contact Vicki Nash, Director Scotland, who is Ofcom's consultation champion:

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

Tel: 0141 229 7401
Fax: 0141 229 7433

Email vicki.nash@ofcom.org.uk

Annex 2

Ofcom's consultation principles

A2.1 Ofcom has published the following seven principles that it will follow for each public written consultation:

Before the consultation

A2.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

During the consultation

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

A2.4 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened version for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will normally allow ten weeks for responses to consultations on issues of general interest.

A2.6 There will be a person within Ofcom who will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organizations interested in the outcome of our decisions. This individual (who we call the consultation champion) will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why. This may be because a particular issue is urgent. If we need to reduce the amount of time we have set aside for a consultation, we will let those concerned know beforehand that this is a 'red flag consultation' which needs their urgent attention.

After the consultation

A2.8 We will look at each response carefully and with an open mind. We will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

Annex 3

Consultation response cover sheet

A3.1 In the interests of transparency, we will publish all consultation responses in full on our website, www.ofcom.org.uk, unless a respondent specifies that all or part of their response is confidential. We will also refer to the contents of a response when explaining our decision, without disclosing the specific information that you wish to remain confidential.

A3.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality by allowing you to state very clearly what you don't want to be published. We will keep your completed coversheets confidential.

A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.

A3.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at www.ofcom.org.uk/consult/.

A3.5 Please put any confidential parts of your response in a separate annex to your response, so that they are clearly identified. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your coversheet only so that we don't have to edit your response.

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

What do you want Ofcom to keep confidential?

Nothing	☐	Name/contact details/job title	☐
Whole response	☐	Organisation	☐
Part of the response	☐	If there is no separate annex, which parts?	

DECLARATION

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

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

Name Signed (if hard copy)

Annex 4

Consultation questions

Question 1: do you agree with Ofcom's proposed overall approach to improving the management of public sector spectrum holdings and, in particular, with Ofcom's conclusion that it will generally be preferable for public sector bodies to interact directly with the market?

Question 2: what factors do you consider Ofcom should take into account in determining the programme of reform in the framework for managing public sector spectrum holdings?

Question 3: do you consider that the proposals should be phased in?

Question 4: do you agree with Ofcom's proposals about the frequency bands that offer the greatest potential benefits from band sharing? Are there other frequency bands where the facility to trade or lease spectrum from public sector bodies would be particularly attractive?

Question 5: do you agree with Ofcom's proposed approach to awarding public sector licences and RSA?

Question 6: should public sector spectrum trading be introduced at this stage in the Channel Islands and Isle of Man?

Question 7: should there be additional grounds, eg safety-related, for Ofcom to refuse consent to a proposed trade in certain frequency bands or for certain applications?

Annex 5

Impact Assessment

Introduction

A5.1 The analysis presented in this annex represents a preliminary impact assessment, as defined in section 7 of the Communications Act 2003 ('the Communications Act').

A5.2 You should send any comments on this impact assessment to us by the closing date for this consultation. We will consider all comments before deciding how to proceed.

A5.3 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making. This is reflected in section 7 of the Communications Act, which means that generally we have to carry out impact assessments where our proposals would be likely to have a significant effect on businesses or the general public, or when there is a major change in 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.

The citizen and consumer interest

A5.4 Ofcom has 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. Ofcom has identified the following areas in particular where the issues raised may have an impact on citizens and consumers and these have informed Ofcom's 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 Ofcom 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 to them. Ofcom notes that there might still be 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 services from alternative commercial uses while maintaining essential public services.

Ofcom's policy objective

A5.5 Ofcom's 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.

A5.6 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.

A5.7 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.

A5.8 The Government's *Forward Look*[52] 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.

Options considered

A5.9 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 related to this is the issue, discussed in section 4 of the main body of this document, of whether public sector bodies should release spectrum directly to the market or through Ofcom. Other significant issues addressed in this document 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

A5.10 Ofcom has considered three options.

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

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. Ofcom 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.

A5.11 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 A5.4 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[53] estimated that the benefits of spectrum trading and liberalisation combined are about nine times those from trading alone. Ofcom therefore concludes that it would be beneficial to extend both trading and liberalisation to public sector spectrum holdings, although there might need to be exceptions that will be considered in a further consultation. There would be safeguards to ensure that national security and public safety remain paramount as outlined in the main body of this document.

A5.12 A key point in this connection is that it will be a matter for the public sector users concerned to decide, within the framework agreed with HM Treasury as part of the CSR, whether and on what terms to enter into trading or sharing arrangements while maintaining public safety and national security. It seems reasonable to assume that the responsible public sector bodies will satisfy themselves that the transactions that they enter into will not have an unacceptable effect on security or safety. In addition, they will be able to intervene directly using their own powers to prevent the bodies that they regulate from making disposals of spectrum that would have undesirable effects on safety and advise Ofcom on technical band sharing criteria.

A5.13 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 assessment when Ofcom consults later this year. The outcome might affect the conclusions of this preliminary impact assessment.

Costs and benefits

A5.14 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 can be substantial and may be of the order of £1bn a year[54], although such estimates are difficult to quantify and are subject to wide margins of

[53] *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

[54] 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

uncertainty. The 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 that 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. Ofcom concludes that the potential benefits from spectrum trading and liberalisation in the public sector are real and significant even if they cannot be precisely quantified.

A5.15 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[55] assumed that costs of trading in the commercial sector would be about 5% of the total benefits. It will be for departments to secure the resource they need through the CSR process.

   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[56] 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.

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

A5.16 In addition, spectrum trading might give rise to market failure in which a public service has insufficient spectrum to operate effectively and maintain the desired standard of its service or insufficient spectrum is available to achieve a particular public policy objective or provide the optimal amount of a public or merit good. Decisions on spectrum release or sharing could be considered in the UKSSC and Ofcom directed to make an administrative assignment in justified cases.

[55] http://www.ofcom.org.uk/consult/condocs/spt_wtr/statement/stwtr.pdf
[56] http://www.ofcom.org.uk/consult/condocs/spec_trad/

A5.17 In view of the uncertainties referred to above in estimating trading and liberalisation outcomes, Ofcom does not consider 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 A5.1: 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 sector bodies to release and acquire spectrum Enhanced spectrum efficiency Enhanced public sector efficiency	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 will be able to withhold consent for trades that contravene international obligations
	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 administrative 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	Ofcom will discuss with Government information to be

	security	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 2007 CSR. Scope for public-private partnership.
	Public sector bodies have insufficient spectrum	Bodies can assess their needs and choose not to trade. If they do, they can acquire more spectrum through the market and, where 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. Targets could be set in CSR. Effectiveness of policy will be reviewed in 2012.
	Excessive transaction costs or burdensome procedures	Ofcom 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. Ofcom 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
	Unforeseen consequences of change	Ofcom will consult extensively with stakeholders and be ready to revise procedures if necessary. Phasing (see below) would also mitigate this risk.
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

A5.18 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 prevent otherwise beneficial transactions from taking place.

A5.19 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.

A5.20 Ofcom sees no reason to believe that trading and liberalisation would not 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 discussed in this document, steps will be taken to avoid this and ensure that public safety and national security remain paramount.

A5.21 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.

A5.22 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.

A5.23 Ofcom therefore believes that there are good grounds to conclude that option 2 is, in general, most likely to secure the socially optimal outcome.

Initial conclusions on trading and liberalisation

A5.24 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 Ofcom believes that they can be effectively managed or mitigated as set out in the above table.

Introduction of RSA

A5.25 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 A5.2: 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 incentives Government support for band sharing as expressed in response to the Audit and *Forward Look* Targets for spectrum release set by CSR

Initial conclusion on RSA

A5.26 The introduction of public sector RSA is necessary to support the widest possible introduction of trading in the public sector. The risks associated with public sector RSA are manageable in Ofcom's view and the costs are outweighed by the benefits.

Phased introduction or single step

A5.27 The two options Ofcom has considered are:

- 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; or
- a single step introduction across all public sector spectrum holdings at the same time.

A5.28 This issue is discussed in section 5 of the main body of this document. The costs, benefits and risks are summarised in the following table.

Table A5.3: 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

Initial conclusion on phasing

A5.29 It appears to Ofcom that the balance of advantage favours a phased approach. 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.

The preferred option

A5.30 Taking into account the above analysis of costs, benefits and risks, Ofcom is of the view that, on balance, introducing spectrum trading and liberalisation on a phased basis and enabled by the introduction of public sector RSA is the appropriate option to meet Ofcom's objectives and is proportionate to the risks. This is because it provides maximum potential for incentivising band sharing by the public sector. While it carries some risks, these can be mitigated and managed to be acceptable.

A5.31 Costs to spectrum users are low relative to the potential benefits, which could be of the order of £1bn a year[57]. There could be significant costs to public bodies but the Government is budgeting to meet these and they are also likely to be less than the potential benefits. The benefits might take a few years to be fully realised but the policy will be subject to review as described below and revised as necessary in the light of the outcome.

A5.32 Ofcom would welcome comments on this preliminary impact assessment and, in particular, on whether there are additional factors that should be taken into account or any further evidence that is relevant to the matters discussed.

Policy review

A5.33 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 proposals in this document form a key part.

[57] See footnote 54 for source

Annex 6

Spectrum trading modes

Introduction

A6.1 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.

A6.2 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

A6.3 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 or totally or partially, appertain to both the purchaser and the vendor simultaneously

A6.4 In partial transfers, the rights or obligations may be divided by frequency band, geographical coverage or time.

A6.5 The four types may be combined in different ways to create four trading modes.

A. total, outright

B. total concurrent

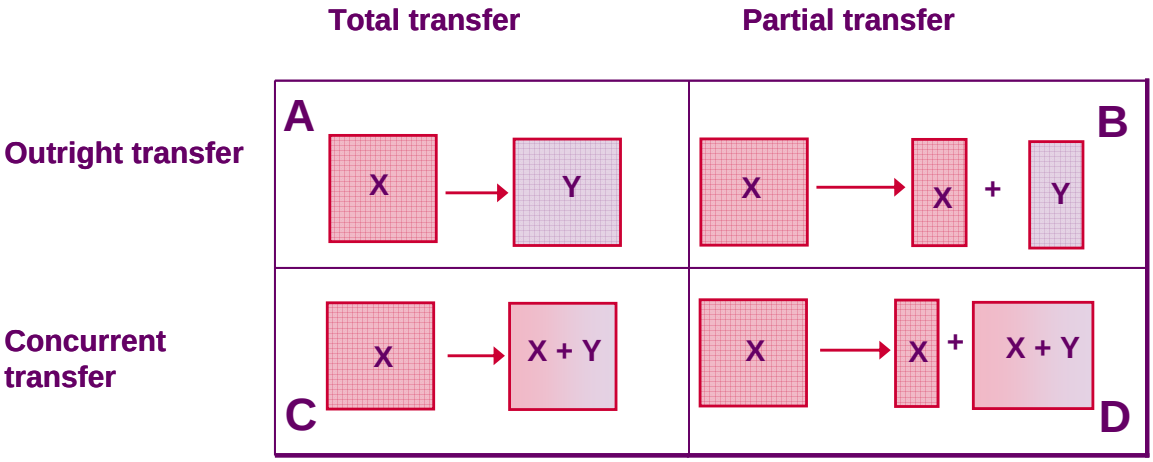
C. partial outright

D. partial concurrent

A6.6 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. If the transferor does not need this but nonetheless wishes to regain the holding after a certain period of time, the parties can agree contractually to reverse the

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

Figure 7: Modes of trading spectrum



A6.7 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 Ofcom has said that it intends in due course to provide for trades that unwind automatically after a predetermined time without the need for an additional transaction.

A6.8 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 to allow trading of RSA.

A6.9 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 Wireless Telegraphy Act 2006 on unauthorised installation or use of such equipment does not bind the Crown. Conversion is necessary in order to authorise a private sector purchaser to establish or use radio equipment in the spectrum in question. Conversion combined with trading would allow a holder of RSA to sell all or part of the RSA to a commercial body and, at the same time, convert it into a licence.

Annex 7

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.
CAA	Civil Aviation Authority – an 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*
DCLG	Department of Communities and Local Government
DoH	Department of Health
DBERR	Department for Business, Enterprise & Regulatory Reform (formerly the Department of Trade and Industry)
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 an 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
Independent Audit	Independent Audit of Spectrum Holdings commissioned by HM Treasury and led by Professor Martin Cave

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
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*
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
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*