



department for
culture, media
and sport

Enabling UK growth – Releasing public spectrum

Making 500 MHz of spectrum available by 2020

March 2011

improving
the quality
of life for all

BIS | Department for
Business Innovation & Skills

 HM TREASURY



MINISTRY OF DEFENCE

Department for
Transport



 Department
of Health



Ed Vaizey
*Minister for Culture, Communications
and Creative Industries*



Edward Davey
*Minister for Employment Relations,
Consumer and Postal Affairs*



Lord Sassoon
Commercial Secretary to the Treasury



The Rt Honourable Andrew Robathan
*Minister for Defence Personnel,
Welfare and Veterans*



Mike Penning
*Parliamentary Under Secretary of
State at Department for Transport*



Nick Herbert
*Minister of State for Policing and
Criminal Justice*



Baroness Hanham CBE
*Parliamentary Under Secretary of
State at Department for Communities
and Local Government*



Simon Burns
Minister of State for Health

Foreword

Spectrum is a valuable resource that enables growth and innovation by the private sector. Spectrum is also essential to the running of public services including defence, emergency services and transport. However, as part of the Government's drive to manage more effectively the nation's assets, we are committed to releasing surplus public sector spectrum to more productive private sector use.

Communications is an innovative, expanding sector. It also underpins growth in other economic areas, not least the creative industries. But wireless services require one vital, and scarce, resource – spectrum. And around half of the most valuable spectrum is under the Government's, our, control.

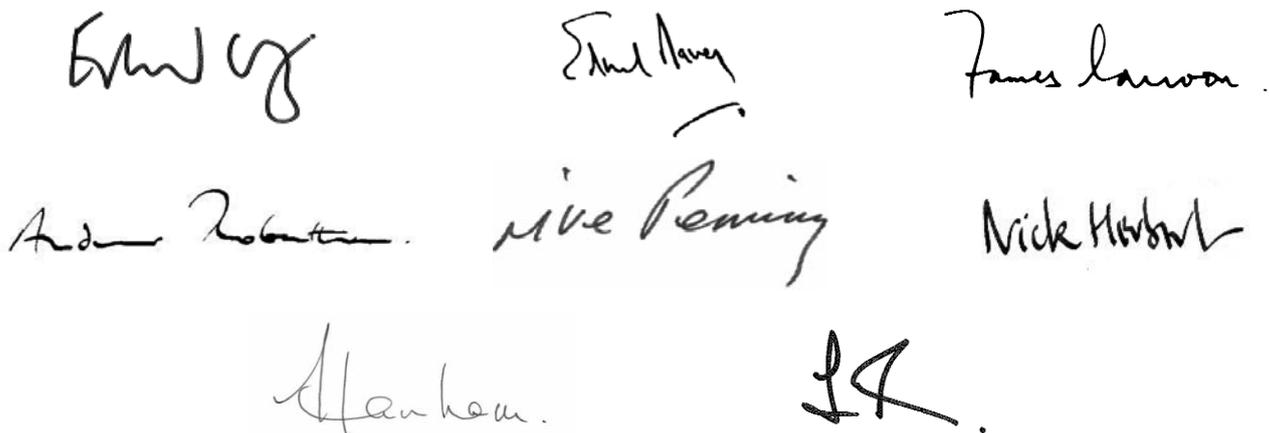
When, after we took office, we looked at the public sector's spectrum we were quickly convinced that there was opportunity to manage it more effectively. Despite years of study showing what was possible, almost no spectrum has been released from the public sector. While we are clear that our security, safety, and other obligations will continue to be met, against the background of soaring demand for communications services we do not think this lack of release is sustainable.

One of the first things that we did as a new Government was to direct Ofcom to ensure that they would release some of the most valuable spectrum – a process that had stalled for many years. But this is only a start, and that is why we have set our target to release 500 MHz of the most valuable public sector spectrum by 2020.

We do not underestimate the challenges in meeting this target and it is rightly ambitious. Changes to spectrum use will take concerted effort in the UK, and internationally, throughout the 10 years.

However, with the right incentives and collaboration across Government we believe that our goal is entirely achievable. Indeed, as we embark on this journey we are confident that we can meet, or even exceed, the target we have set.

This document will tell you how we intend to do it and we would welcome your views.



Ed Miliband
Ed Balls
James Hancock
Alistair Robert
Nive Pening
Nick Herbert
Hannah
IA

Contents

	page
Foreword	3
Section 1: Executive summary	5
Section 2: The context	8
Section 3: Public sector holdings and uses	13
Section 4: Demand for spectrum	17
Section 5: Release issues	24
Section 6: Strategy for release	28
Section 7: Preliminary views on the 500 MHz	31
Section 8: Conclusions and next steps	36
Annex 1: References	38
Annex 2: Oversight of the release programme	39
Annex 3: Call for evidence	40
Annex 4: Glossary	41

Section 1: Executive summary

Introduction

- 1.1 Spectrum¹ is a valuable resource that enables growth and innovation. Without it wireless communications such as mobile phones, or Wi-Fi or satellite TV are not possible. It is also a critical input to enable delivery of essential services provided, and supported, by the public sector.
- 1.2 Until recently, the way that spectrum has been allocated to the public sector had not been considered for many years and, against the background of increasing demand from both the public and private sector, we have looked at these holdings to see what could be made available for alternative uses. To give this work impetus we announced in the Spending Review that at least 500 MHz of public sector spectrum holdings below 5 GHz would be released by 2020. This document looks in more detail at how this will be done.

Public sector spectrum holdings

- 1.3 The public sector has around half of the most useful spectrum and uses it for a variety of services including defence, emergency services, transport and science. As with all other communications services, the public sector's spectrum needs are changing as technologies develop and services that we provide evolve. In order to better understand these changing needs a number of studies have been carried out on what spectrum is being used by the public sector, what it is used for, and what may be needed in the future. This work provides a basis for further analysis to understand what spectrum may be possible to release.

Demand for spectrum

- 1.4 In addition to the public sector's need for spectrum there is significant demand from commercial users. These include broadcasters, business radio and mobile telecommunications companies who use wireless communications to run their business and deliver services to their customers. Although demand seems to be increasing for almost all applications, it seems to be highest for mobile services. This appears to be driven by:
 - Spectrum hungry consumer services (such as video streaming and social networking) that can be provided on smart phones and other mobile devices
 - Businesses' increasing need to access data on demand
- 1.5 Mobile demand splits between coverage needs (considered to be best met using spectrum below 1 GHz), and capacity needs (which can be met using spectrum above 1 GHz). Ideally the mobile sector would also like to access large blocks of spectrum that are harmonised for mobile use across at least Europe, and preferably the world.

Considerations with spectrum release

- 1.6 Given that spectrum bands are already heavily used, and that spectrum does not respect international borders, there are a number of issues that need to be addressed when deciding which bands to release, how and when.

¹ Unless otherwise indicated, references to "spectrum" in this document should be taken to mean radio spectrum.

- 1.7 When deciding if a band can be freed, we need to consider the existing spectrum users. Many public sector bands are already shared among a number of public and private sector users which adds to the complexity in freeing them for other uses. Consideration will need to be given to what will happen to the services that are currently provided using that spectrum, for example whether they can be moved to another spectrum band, whether the service can be provided without using spectrum, or whether the service can be purchased from a commercial provider.
- 1.8 The international nature of spectrum both provides benefits and raises issues. Much of the value from spectrum use can be increased if a band is allocated for the same purpose internationally. For example increased equipment volumes reduce costs and equipment can be used abroad. However issues can arise if the international agreements that bind the way that spectrum can be used need to change, as securing changes can take many years.

General approach to release

- 1.9 When deciding which bands to release we will look at bands that would meet expected demand, provide value and are feasible to be released. Before making a decision on the release of any band we will need to carry out a cost-benefit analysis.
- 1.10 To provide certainty to industry, to help planning, and to ensure an orderly series of spectrum releases, where appropriate we expect to coordinate our spectrum release plans with Ofcom.

Specific releases

- 1.11 Based on the criteria above, the Ministry of Defence (MoD) has identified two bands (2310-2390 MHz and 3400-3600 MHz) from which they expect to release 160 MHz of spectrum.
- 1.12 In addition we have identified three other bands (2700-3100 MHz, 3100-3400 MHz and 4400-5000 MHz) which we think are priorities for further investigation. Depending on what this yields we have identified a further five bands above 1 GHz and five bands below 1 GHz that could, with further work, yield spectrum towards the 500 MHz target.

Next steps

- 1.13 As we move forward with this programme, if appropriate, departments will plan to run consultations ahead of the release of specific bands. However we are still refining our ideas, so this document incorporates a call for evidence to gain views on a number of aspects of our release programme. We would welcome your thoughts by **midday on 23 June 2011**. In parallel with that, we are planning to carry out further activities to understand some areas in more detail and drive releases forward. Specifically:
- MoD will continue the work to free up the priority bands they have identified and we will consider the best time for these to be released, taking into account other planned spectrum releases
 - The Department for Transport (DfT), with the support of the Civil Aviation Authority (CAA), MoD and the Maritime and Coastguard Agency (MCA), will look at release issues, and how they can be resolved, with the spectrum between 2700-3100 MHz
 - The emergency services will complete their review of their future communications requirements and how that relates to their spectrum needs
 - We will work with Ofcom to consider how releases of public and civil spectrum are best coordinated and to input into the UK's international spectrum strategies

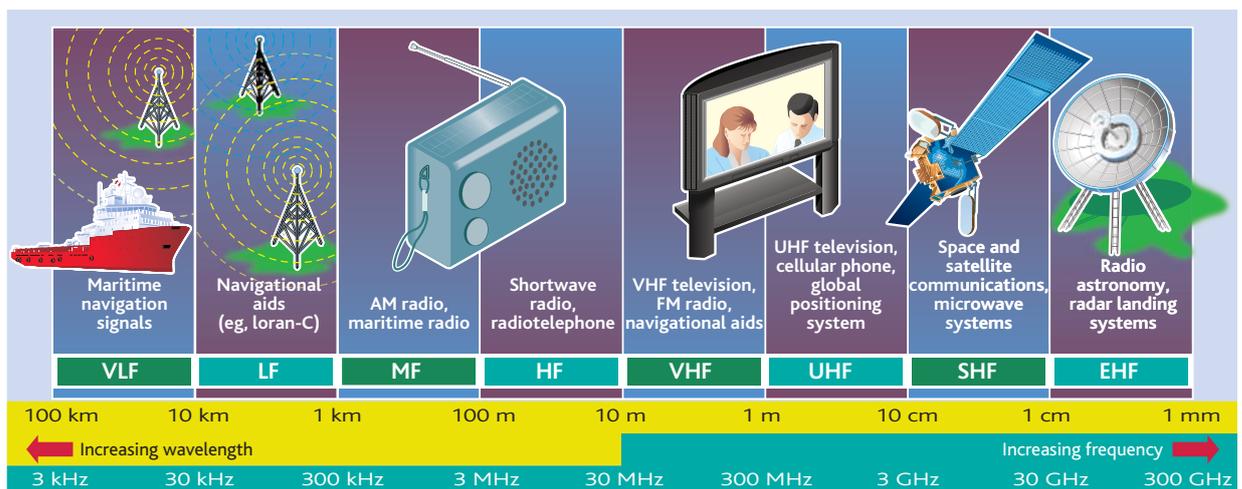


Section 2: The context

What spectrum is and why it matters

- 2.1 Spectrum is a limited resource of considerable economic and social importance. Almost anything requiring electronic communication not connected by a cable will use the radio spectrum in one form or another to provide connection to people on the move, to the fixed networks or for broadcasters. Wireless networks connect people on the move, in the home and in the office, liberating them from a fixed telephone socket on the wall. It does not end there; radio spectrum is also key to delivering a range of services including terrestrial and satellite telecommunications, a wide range of industrial and transport uses, and a range of less obvious uses from car key fobs to baby alarms.
- 2.2 In addition to commercial use, spectrum is critical for non-commercial applications. Defence, transport, science and public safety functions simply could not be delivered as they are today without access to radio spectrum.
- 2.3 Commercial and public uses of spectrum are hugely important to society and the economy, through a variety of applications as shown in figure 1 below. The importance of radio spectrum can be gauged from the fact that a 2006 study for Ofcom estimated that its use underpinned 3 per cent of UK GDP and generated benefits worth over £40bn a year, a figure that had grown by at least 50 per cent in real terms since 2002.²

Figure 1: Uses of spectrum



Adapted with permission from: "Telecommunications media". Encyclopaedia Britannica Online © 2011 Encyclopaedia Britannica, Inc.

- 2.4 Spectrum below 15 GHz is usually regarded as constituting the most useful and valuable part of the radio spectrum as its technical characteristics mean that it can be used for a wide range of applications. For mobile communications, frequencies below about 4 GHz provide 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.

² http://stakeholders.ofcom.org.uk/market-data-research/spectrum-research/economic_spectrum_use. This study did not take into account the use of spectrum for commercial aviation, public safety, defence or science purposes.

- 2.5 A study carried out for the Independent Audit of Spectrum Holdings³ by Analysys Mason 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”.*⁴
- 2.6 More recently, multiple studies have been carried out looking at demand for mobile services. They all suggest significant growth, with the only disagreement seeming to be around the timing and level of the increase in demand.

Spectrum use in the public sector

- 2.7 Public sector spectrum holdings are used for a wide variety of applications including defence and emergency service (radio, aeronautical and maritime radar, meteorology and radio astronomy). These holdings account for nearly half of all spectrum below 15 GHz.
- 2.8 Given the continued increasing demand for spectrum and the amount 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 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.
- 2.9 Spectrum released by the public sector has the potential to contribute to a range of government priorities. For example spectrum is critical to the further deployment of mobile broadband services, making a contribution to our objective to have the best superfast broadband network in Europe by 2015 (although it is likely that the majority of the release of public sector holdings will take place after 2015). It can also provide opportunities for small businesses, who can be amongst the leaders in innovation and growth in the economy and it can help deliver effective, reliable and secure communications infrastructure for consumers and citizens across the UK.

Regulatory framework

- 2.10 As spectrum is a scarce resource and users of spectrum can potentially interfere with each other, spectrum use is subject to an interlocking regulatory framework. This starts at the global level where the International Telecommunications Union (ITU) – an agency of the UN – sets the framework for spectrum use globally and regionally⁵. Many of these agreements have the force of international treaties and can take many years to change. There are also Europe-wide agreements, in particular the European Conference of Postal and Telecommunications Administrations (CEPT) through which much of the detailed technical spectrum work in Europe is undertaken, including to inform the decisions of the European Commission that are binding on the UK.
- 2.11 Specific sectors are also subject to regulatory oversight from bodies such as the International Civil Aviation Organisation (ICAO) and the International Maritime Organisation (IMO). ICAO also publishes international standards and recommended practices which are ratified by member countries; and the IMO standardises uses and technologies through the European Committee for Electrotechnical Standardization (CENELEC).

³ This was an audit of public sector spectrum holdings carried out by Professor Martin Cave in 2005 (link in Annex 1)

⁴ http://www.spectrumaudit.org.uk/pdf/spectrum_demand.pdf

⁵ ITU radio regulations divide the world into three regions with their respective frequency allocations. Details can be found on www.itu.int.

- 2.12 UK private sector spectrum use is managed by Ofcom. Under the Wireless Telegraphy Act 2006, a person may not use spectrum to transmit signals without a licence from Ofcom, unless the use is specifically licence-exempt under Regulations. The requirement to be licensed or exempted does not apply to Crown bodies such as government departments. In practice, to ensure that spectrum is managed properly and that users do not suffer undue interference, the major divisions of which spectrum bands are managed by Ofcom and which by other public sector bodies is recorded in the UK Frequency Allocation Table (UK FAT).
- 2.13 Ofcom has a specific duty placed on it by the Communications Act 2003 to "secure the optimal use for wireless telegraphy of the electro-magnetic spectrum." In addition Ofcom is the independent competition authority for the communications industries.

What has been done already to reform the use of public sector spectrum

- 2.14 The importance and economic value of spectrum has encouraged governments and regulators around the world to look at more efficient uses of this scarce resource. A major project is underway in the US to free up spectrum from public and private holders, whilst in Europe the European Commission has announced the Radio Spectrum Policy Programme which outlines at a strategic level how the use of spectrum can contribute to the most important political objectives of the European Union.
- 2.15 The work proposed in this document is the next step in the modern programme of work looking at government spectrum release that began with the Independent Audit of Spectrum Holdings carried out by Professor Martin Cave. He was asked to review what more needed to be done to ensure that all, including non-commercial, spectrum users, were focused on using spectrum as efficiently as possible.
- 2.16 Professor Cave published his Independent Audit in December 2005 and made over 50 recommendations to improve spectrum efficiency in the public sector in order to help meet a sizeable 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.
- 2.17 His conclusions and recommendations were accepted by the previous administration in March 2006⁶ and in response to this a number of activities have taken place over the last five years. Audits have been undertaken of public sector spectrum holdings as well as analyses of potential demand. As the largest public sector user of spectrum, much of this activity has been undertaken by the MoD, but there has also been work done to look at spectrum use across public sector. Various reports that have been produced as a result of this work are summarised in Annex 1.
- 2.18 In addition to the work done by the individual departments, work has been done to encourage the application of market mechanisms to public sector spectrum use. This includes spectrum payments for public sector spectrum use and now the majority of the public sector make some payments for their spectrum use. It is Government's intention that the public sector should ultimately make full spectrum payments on a comparable basis to the commercial sector.

What we are planning to do now

- 2.19 Despite all of this work there has been limited release of public sector spectrum holdings over the last six years. Given this, the Government has decided to revitalise this process by announcing a specific 10 year target to release 500 MHz public sector spectrum in the Spending Review.
- 2.20 The 2010 Spending Review announced that "at least 500 MHz of public sector spectrum below 5 GHz will be released over the next 10 years for new mobile communication uses, including mobile broadband."⁷ This work has ministerial endorsement and oversight, and a cross-government group has been set up to ensure delivery. More detail on the oversight of this work is in Annex 2.

⁶ <http://www.spectrumaudit.org.uk/pdf/governmentresponse.pdf>

⁷ HM Treasury Spending Review 2010 (http://cdn.hm-treasury.gov.uk/sr2010_completereport.pdf)

- 2.21 Leading the delivery of the specific releases that will make up the 500 MHz will be the responsibility of individual departments. However a cross-government working group will pull together all those strands of work with the intention of:
- Making sure that any synergies are realised (e.g. where it might be possible to carry out a release of a wider band by combining contiguous bands that are managed by different departments)
 - Supporting the coordination activities required to enable the release of spectrum that is shared by different departments
 - Understanding market demand and coordinating the overall government programme of release with Ofcom's release plans to ensure that spectrum is released in an organised manner that will allow industry to absorb it effectively, and to give it visibility and certainty about what will be released and when
- 2.22 The initial responsibilities of this cross-government group will be to:
- Run a public process to gain views to provide a better picture of demand for spectrum
 - Identify the bands that can make up the 500 MHz
 - Develop a programme of actions to overcome any barriers to release
 - Agree the specific actions to be undertaken by the public sector bodies involved
 - Set a timetable for release of the spectrum
- 2.23 The following sections expand on these areas.

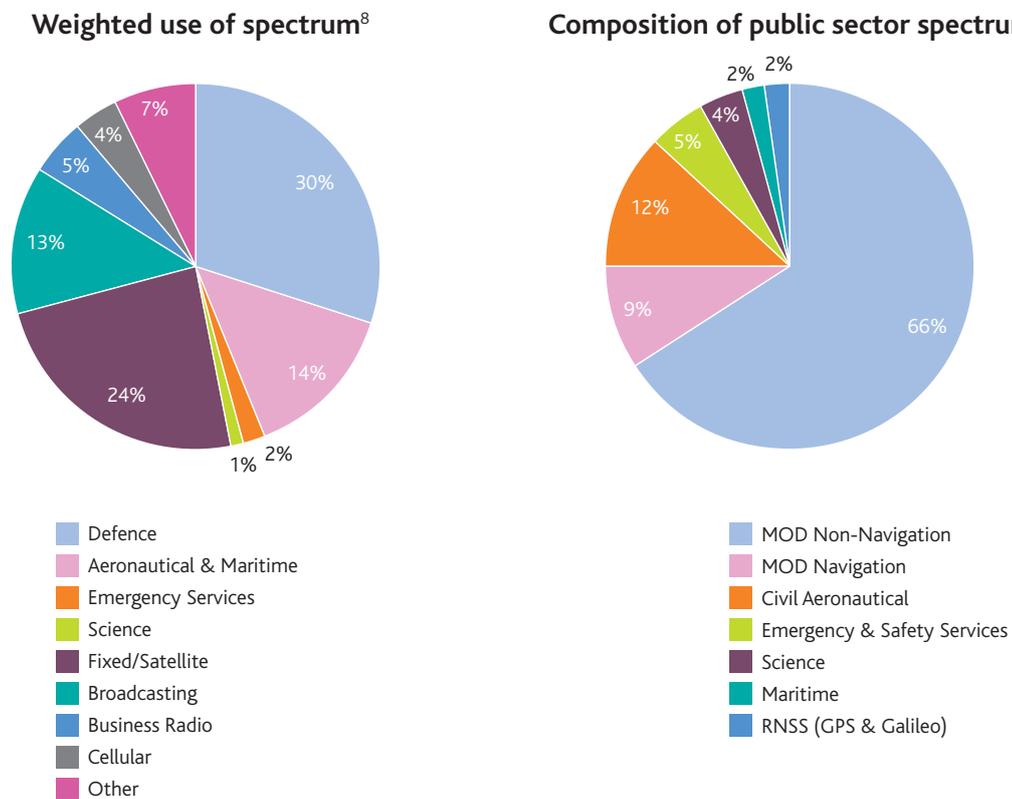


Section 3: Public sector holdings and uses

What the holdings are

3.1 The public sector is a major holder of spectrum with almost 50 per cent of spectrum below 15 GHz currently allocated for use by the MoD, aeronautical and maritime, and emergency services as shown in the figure below.

Figure 2: Weighted use of spectrum and composition of public sector spectrum holdings below 15 GHz



Source: Independent Audit of Spectrum Holdings

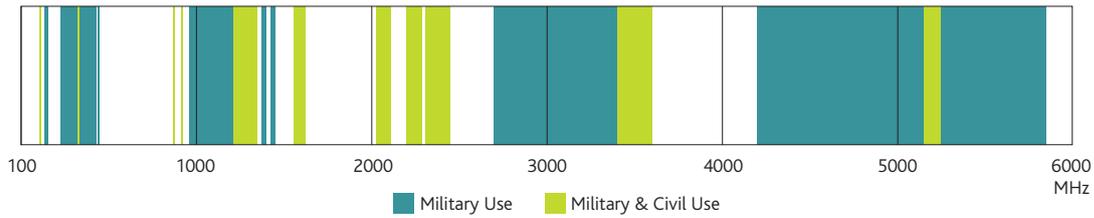
3.2 Public sector holdings in the range 100 MHz and 6 GHz, which are likely to be the most commercially attractive, are set out on the next page in figure 3.

3.3 Public sector holdings sit across the spectrum and reflect the range of applications that are used. As figure 3 illustrates, many bands are also shared. Although the MoD is the primary user of public sector spectrum with around 90 per cent of the total, most of these bands are shared with other public and private sector users. Releasing this spectrum therefore requires a coordinated approach across user groups.

⁸ Figures are weighted so that a 1 MHz allocation at 100 MHz is given equal weight to a 10 MHz allocation at 1 GHz.

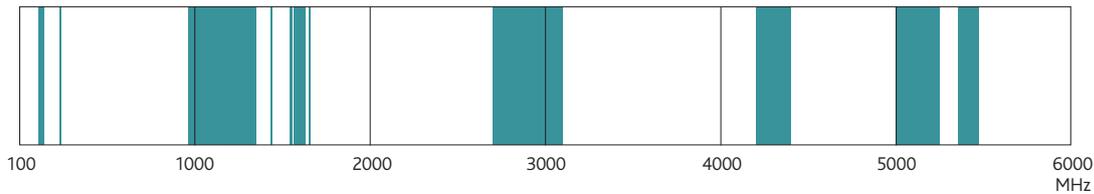
Figure 3: Public sector spectrum allocation between 100 MHz and 6 GHz

Military



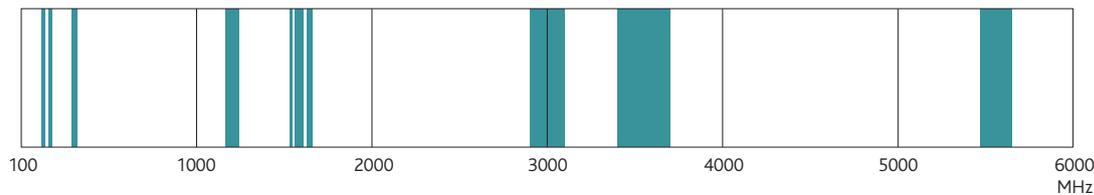
Typical uses: Voice and data links, navigational aids, defence and weapons radar, satellite communications and telemetry

Aeronautical



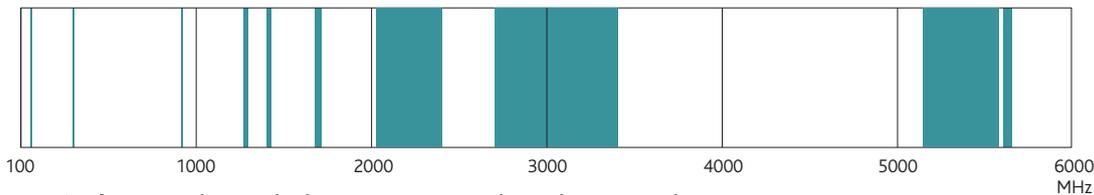
Typical uses: Communications (voice and data), navigation (e.g. marker beacons, microwave or instrument landing systems) and surveillance (e.g. primary and secondary radars)

Maritime



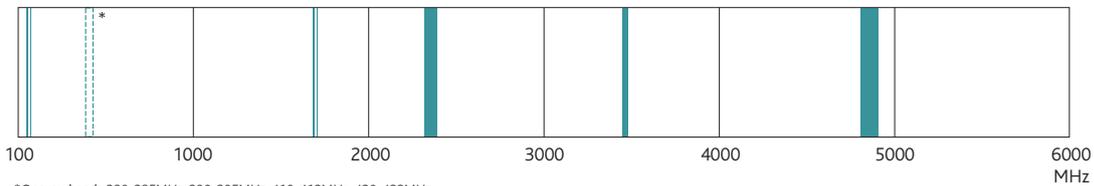
Typical uses: Communications and navigation

Science Services



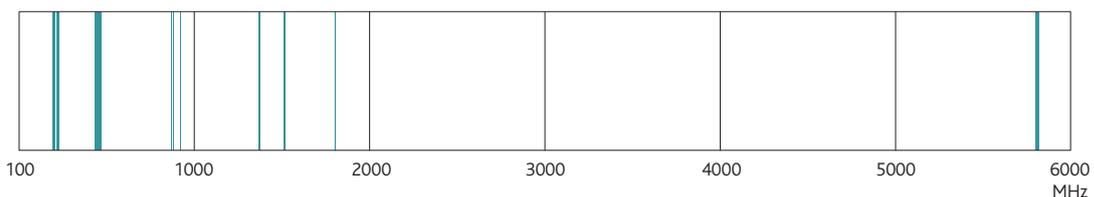
Typical uses: This includes space research and meteorology

Emergency Services



Typical uses: Voice and data communications

Road and Rail



Typical uses: Traffic cameras, real time information and mobile communications

Current uses and expected future requirements

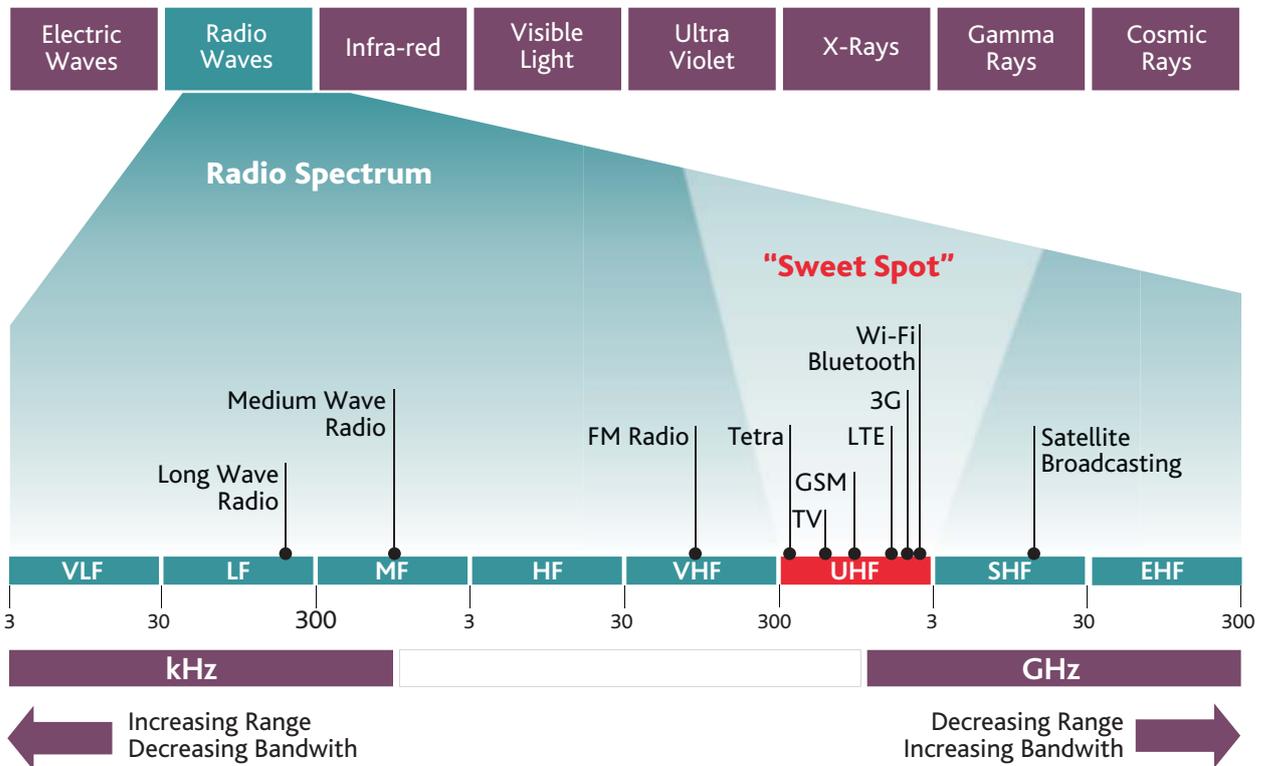
- 3.4 While the UK FAT identifies who is responsible for a spectrum band, it does not identify what it is used for and how heavily it is used. Much work has already been done to look at this across departments, in particular the MoD carried out an audit of their holdings in 2008 as well as an assessment of defence demand for spectrum. Details of these studies are included in Annex 1.
- 3.5 These studies highlight the breadth of critical work that is supported by spectrum use. They also highlight the expectation that public sector spectrum demand in a number of areas is expected to change, and in some bands may increase. However, overall we expect that public sector spectrum holdings will reduce between now and 2020.
- 3.6 One particularly critical area in this is the work that is being done to look at the future needs of the emergency services as existing contracts for core communications come to an end between 2016 and 2020. A programme has recently been established to decide on future communications needs, both for voice and data when these contracts end. Plans are in place to obtain sufficient spectrum for future needs including, but not limited to, the need for additional spectrum in the transitional period should it be decided to move to an alternative supplier in future. Overall, the net impact on spectrum is not yet clear. The future requirements of the emergency services are likely to lead to additional spectrum being needed in some areas, but is likely to lead to other bands being released.



Section 4: Demand for spectrum

- 4.1 Rapid strides in cellular mobile and wireless broadband alongside developments in other areas like broadcasting, utilities, and innovation in machine to machine applications have resulted in increased demand for spectrum for a variety of uses. We listed in section 3 some of the work that has been done to identify the public sector’s future spectrum demand. Therefore this section focuses on commercial demand.
- 4.2 All other things being equal, data carried over spectrum in lower frequency bands carry over greater distances and has better building penetration than can be achieved if it were carried over higher frequencies. However lower frequencies carry less data than those at higher frequencies. Networks built for higher frequencies tend to require a higher capital investment (as the areas covered by each base station is smaller so more are required to cover the same geographic area as those systems using lower frequencies) hence prove economically viable only in dense urban areas such as city centres (due to the high demand in these areas) or for fixed links (point to point). Very low frequencies also become unviable for mobile communications due to the need for larger antenna.

Figure 4: Spectrum usage



Source: Ofcom, PWC

- 4.3 It is for these reasons that the frequencies in greatest demand and value are those between about 300 MHz and 3 GHz, which combine the benefits of better coverage properties with capacity to carry larger amounts of data. This range is generally considered to be prime spectrum, or the 'sweet spot' as shown in figure 4 on the previous page. The figure also illustrates the number of important technologies that have been developed to utilise the qualities of this spectrum.

Major drivers of commercial spectrum use

- 4.4 As mobile services, wireless broadband and use of advanced devices become more widespread, consumers expect greater access to communications services and the internet. Specific examples include:
- Increasing 3G coverage across the country (e.g. 90 per cent of the UK's population)⁹
 - Growth in take-up of smart phones and other advanced hand held mobile devices (70 per cent annual growth rate)¹⁰
- 4.5 In addition, business and mission critical private and public networks require high levels of connectivity and reliability of service. Specific examples include: emergency services, transport systems and utility sector systems.
- 4.6 Whatever the services to be delivered, the consensus is that additional spectrum is required to improve geographic coverage and to add capacity to existing or new networks.
- 4.7 The availability of new products and services has placed significant demands on spectrum use. Not only do new services, such as mobile broadband, require spectrum in order to launch, but their availability and take up then creates further demand and a further need for spectrum.
- 4.8 In particular, advances in mobile technologies and the development of attractive services capable of taking advantage of these technologies are fuelling higher use of data such as live video streaming. These include:
- Video in improved formats (HD/3D) and broader band data applications
 - Increasing use of Wi-Fi (in-building broadband and for mobile off-load)
 - Machine to machine communications in wide range of contexts
- 4.9 Finally, government policy priorities, such as the development of a superfast broadband network, are likely to add to the need for wireless communications infrastructure and the associated use of spectrum.

Potential commercial demand by user group

- 4.10 A wide range of possible applications has been considered using information from previous market demand studies and initial discussions with a cross section of the industry to gauge demand. Their responses are summarised in table 1 below.

⁹ Source: P 316, Ofcom, International Communications Market Report 2010, December 2010

¹⁰ Source: P 210, Ofcom, International Communications Market Report 2010, December 2010

Table 1: Overview of potential commercial demand for additional spectrum

Use	Drivers	Desired Spectrum Bands	Note
Cellular mobile	Growth in mobile broadband Cost reduction Better in-building coverage	Additional IMT-2000 bands in 500 MHz to 4 GHz range, and new bands under 3 GHz	Up to 500 MHz desired over next 10-15 years Ideally configured as 20 MHz channels
Business radio ¹¹	Growth narrowband data applications Broadband data requirements	400-470 MHz	Up to 2x1 MHz for narrowband particularly in congested urban areas 2x5 MHz for video/broadband
Terrestrial TV broadcasting	Move to HD increases demand Additional TV channels Terrestrial PSB coverage	600-700 MHz	Opportunity to bid in Ofcom auction of spectrum at 600 MHz
Wireless cameras for programme making	HD Additional cameras to enhance service Loss of bands used historically	<3 GHz for mobile use >4 GHz for localised use	Multiple 10 MHz channels desired – one per camera at a location
Wireless broadband access ¹²	High speed rural broadband – final third of population (potentially a national network)	<1 GHz but could make use of frequencies at 2-4 GHz	At least 40 MHz desired
Utilities	Telemetry & control – utilities Smart grids (sub-stations) Smart metering	Around 450 MHz for smart metering and smart grid in rural areas Around 3.5 GHz and 5 GHz for smart grid	2x2 MHz across Europe for smart metering 2x5 MHz for smart grid
Fixed links	Backhaul for broadband – fixed and mobile	Around 3.5 GHz in rural areas Around 10 GHz in urban areas	Over 100 MHz desired
Cognitive white space use	Low cost low power M-2-M network – wide range of potential applications Rural broadband	<1 GHz	30-60 MHz desired with 8 MHz channels – already available in UHF TV bands
Wi-Fi	Broadband and HD video distribution in buildings/homes/enterprises Wide area wireless LANs	Around 2.3 GHz for premium Wi-Fi Around 5 GHz	Up to another 300-400 MHz desired Over next 5-10 years

Source: Plum Consulting, BIS

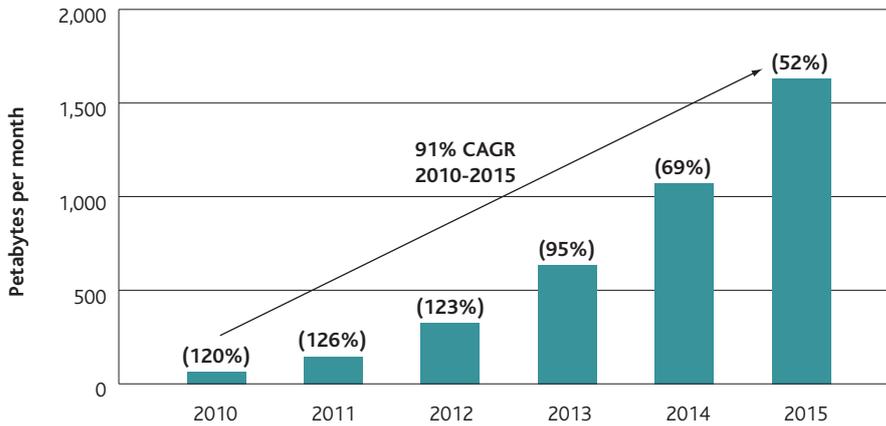
¹¹ Business radio refers to private mobile networks ancillary to main operations (e.g. transport, security or construction)

¹² Wired broadband access using spectrum for last mile connectivity

Cellular Mobile

4.11 Cellular mobile is currently one of the most significant users of spectrum in UK and our discussions suggest that it will also be the source of the highest demand for spectrum over the next 10 years. This is primarily due to the expected growth in data traffic over the coming years. In Europe, Cisco project that data traffic will grow at a compound annual growth (CAGR) rate of 91 per cent in 2010-15 as indicated in figure 5 below¹³.

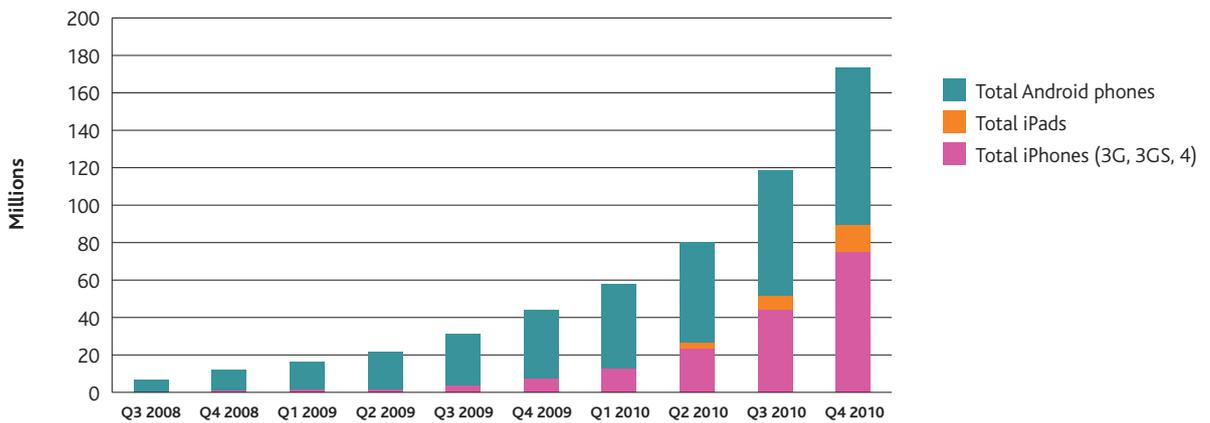
Figure 5: Mobile data traffic forecast – Western Europe (2010-15)



Source: Cisco

4.12 Drivers of this growth are the take up of advanced devices (figure 6) with growth in data use per user and developments in technology (figure 7) resulting in enhanced user experiences coupled with consumers' increasing expectation that wireless speeds will match those of wired.

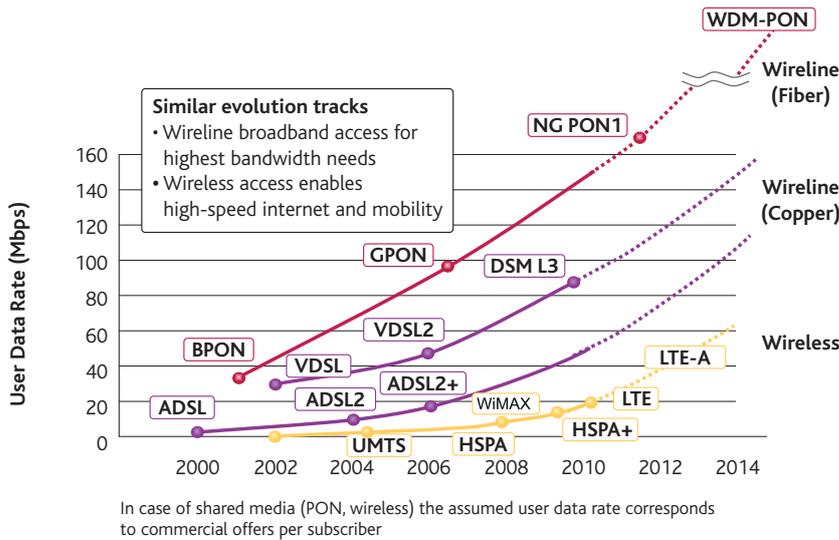
Figure 6: Total global number of iPhones, iPads & Android phones sold



Source: Plum Consulting, Apple quarterly financial results, Gartner

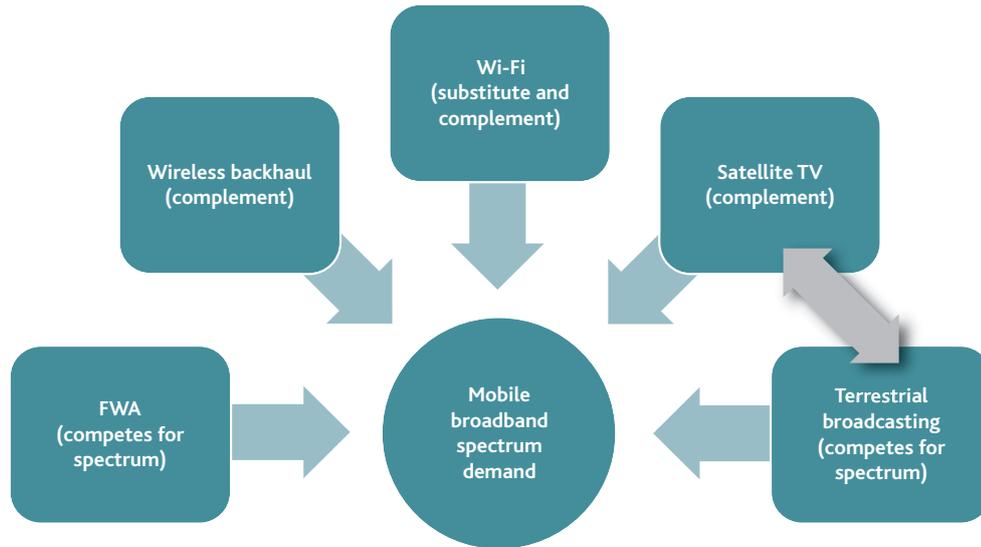
¹³ http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf

Figure 7: Development of access technologies



Source: Nokia Siemens Networks

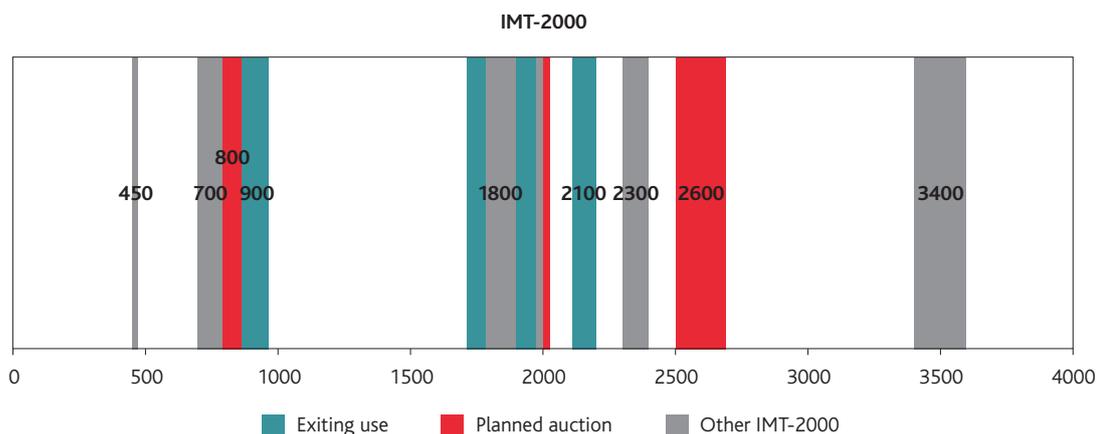
- 4.13 Increased data demand does not translate directly to increased spectrum demand as there are a number of other actions that mobile operators can take (e.g. network re-planning) to help to meet the demand. Notwithstanding this, those we have spoken to have indicated that additional spectrum will be required to meet the growth in demand for data and speed.
- 4.14 In addition to new products and services and the user demand these generate, other factors influence commercial users’ appetite for spectrum. These include:
- Harmonisation:** Globally or Europe-wide harmonised spectrum enables economies of scale in equipment production and international mobility.
 - Timing of release:** Given the other UK spectrum releases, there could be some uncertainty in the timing of demand for additional spectrum as new licensees look to absorb what they have acquired.
 - Consumers’ willingness-to-pay:** Demand is a function of price, so demand for spectrum is linked to consumers’ willingness-to-pay for the services spectrum enables. Operators might seek to manage demand through pricing and volume caps if willingness-to-pay is limited.
 - Cost considerations:** Availability of more spectrum could reduce the cost of roll-out. However, there is a need for a balance between low and high frequencies for coverage and capacity. There is also any cost of acquisition.
 - Other delivery platforms:** Greater availability of fibre networks and the ability to off-load mobile traffic to fixed networks will influence spectrum demand.
 - Demand interactions:** A number of areas of demand for spectrum are shown in table 1. There are likely interactions between these demands and mobile – some are complementary and others are substitutes (see figure 8).

Figure 8: Illustrative spectrum use and demand interactions

Source: Plum Consulting

Cellular mobile spectrum requirements

- 4.15 In addition to the points above, mobile operators also expressed other desires.
- Spectrum below 3 GHz:** A number of frequencies below 3 GHz are already designated for mobile use with equipment already available.
 - Large contiguous blocks:** Operators ideally want 2 x 20 MHz of contiguous spectrum holdings in order to support broadband with potential for future expansion.
 - Early resolution of adjacent band issues:** Operators would like to see adjacent band issues (like interference) resolved early-on to provide confidence, supporting investment in faster roll-out.
 - Technology/service neutrality:** Some consider that the best use of spectrum could result if it is released as technology and service neutral with the possibility for trading in future.
 - Visibility of timing:** Operators want visibility of upcoming spectrum auctions with the timing of releases coordinated with Ofcom.
- 4.16 As indicated in figure 9 below, a number of frequency bands are already identified for mobile use. Those not already available in the UK could be considered for release for mobile use in future.

Figure 9: IMT-2000 bands for mobile use

Source: Plum Consulting

Other users

- 4.17 A number of other users have also been found to have a likely need for spectrum. These could have wider economic and social benefits. These groups may require only small amounts of spectrum, or spectrum that requires involve local and/or intermittent frequency use.
- 4.18 In addition, there are a number of other uses that are licence-exempt such as machine to machine communications, utilities and Wi-Fi. Our discussions suggest that there will be a proliferation of wireless-enabled devices for licence-exempt use and that this is likely to foster a number of innovations.

Table 2: Other users' requirements

	Spectrum desired	Notes
Business radio	Bands below 400 MHz	They would like 2x1 MHz and 2x5 MHz channels
Fixed links	Bands around 3.5 GHz and around 10 GHz	There is a particular demand for 3.5 GHz in rural areas
Wireless cameras	<3 GHz for mobile use >4 GHz for localised use	
Machine to Machine	<1 GHz	Potential spectrum already available in the whitespace around UHF TV bands
Utilities	Bands around 450 MHz, 3.5 GHz and 5 GHz	This would be for smart metering and grids Grids only around 3.5 GHz and 5 GHz
Wi-Fi	5-6 GHz	International harmonisation would be particularly important here

Source: Plum Consulting, BIS

Q1: What services do you think are most likely to demand spectrum from the public sector holdings between now and 2020 and when? Please provide evidence to support your answer.

Section 5: Release issues

- 5.1 Freeing spectrum for alternative use may often be complex, with long lead times to implement and can be costly. This is because:
- Many bands are subject to international agreements and regulations which may constrain alternative uses, and take many years to negotiate and change
 - Bands are often shared between more than one user, which requires a coordinated approach to release
 - Changes of use in a band and the introduction of new equipment can require interference issues to be solved
 - Moving users can entail retuning or replacing equipment, with associated costs
- 5.2 Some of the issues need to be addressed early on in the process, such as international harmonisation and regulatory constraints, while others need to be managed as part of the preparatory and transition works to release a band.

International agreements and regulations

- 5.3 Spectrum is managed and coordinated on a global, regional and national basis through a number of authorities as discussed in section 2. The international bodies' goal is to maximise the usability of the spectrum for the largest possible group of potential users, while minimising the risks of harmful interference between nations' specific choices.
- 5.4 Harmonisation of spectrum bands across national boundaries is important for many applications. In transport, particularly aviation, harmonisation of communications and safety systems is extremely valuable for international travel. Closer integration in this area can reduce the amount of equipment that aircraft need to carry, with potentially substantial cost savings and environmental benefits. For commercial applications, such as mobile telecommunications, harmonisation of bands is important to ensure that equipment works across borders and allows for economies of scale delivering convenience, lower costs to users and incentives for investment.
- 5.5 Many of these international agreements can take years to change. International decisions or directives put forward with regard to specific bands can have a direct impact on UK releases.
- 5.6 It will therefore be important to consider the UK's spectrum release plans with international initiatives in this area.

Band Sharing

- 5.7 As we have seen, public sector bands are usually shared among multiple users and for different applications. Memoranda of Understanding are currently being prepared between the MoD and each of the other public sector users sharing MoD bands outlining the responsibilities and obligations of each of the parties sharing spectrum, therefore enabling further future cooperation and coordination as bands are considered for release. Finalisation of these agreements will be important to allow spectrum to be released as quickly as possible should a decision be made to release a shared band.

5.8 Even if a band is identified by one user as under-utilised or as likely to be no longer required at some point in the future due to expected changes in services, in order to be in position to free the band and allocate for an alternative use an agreement may need to be reached by all current users of the band. For example part of the spectrum identified for possible release by MoD within the 3400-3600 MHz band is currently used by emergency services. In this case the MoD has agreed to fund the works required to free the band to enable the release of the band within the envisioned timeframe.

Interference

5.9 In addition to considering users within the same spectrum band we also need to consider possible interference between bands. For example, in order for Ofcom to be in position to proceed with the auction of the 2500-2690 MHz band, modification works need to be carried out by MoD and the civil aviation community on radars operating within the 2700-3100 MHz band to mitigate interference risks. Spectrum management, allocation and engineering all operate on the principle of securing the coexistence of similar radiocommunications services without harmful interference. Improved technology or planning could also allow for more effective use of bands thus allowing current usage to be compressed within less spectrum or additional users added to a band.

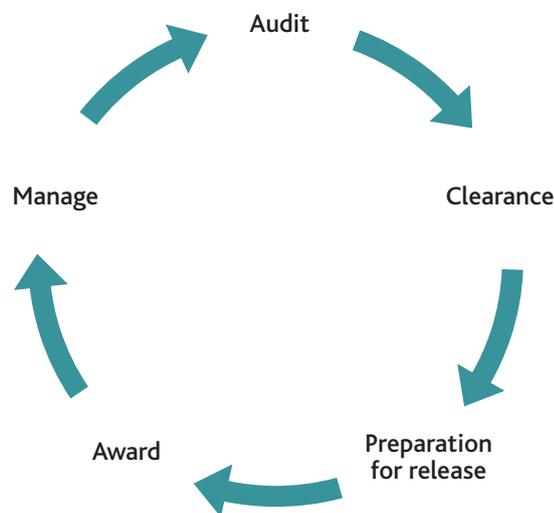
5.10 When looking at possible alternative uses for bands currently used by the public sector, we (together with Ofcom) will also consider the balance between providing sufficient frequency separation to protect users from the risk of interference, and the value that could be obtained by making other adjustments, so freeing up the band for other users.

Moving existing users and managing transition

5.11 Once bands are identified for potential release, all affected parties need to work together to ensure a smooth transition process. Different steps will need to be taken depending on whether services are no longer required; whether services are to be moved to another band or whether modification of equipment is required to avoid interference.

5.12 In order to release any spectrum there are a number of generic processes that usually, although not always, need to take place: auditing, clearance, preparation for release, award and then management. This can be considered as a spectrum management lifecycle as shown in figure 10 below. Each of these elements is considered in more detail below.

Figure 10: Spectrum management lifecycle



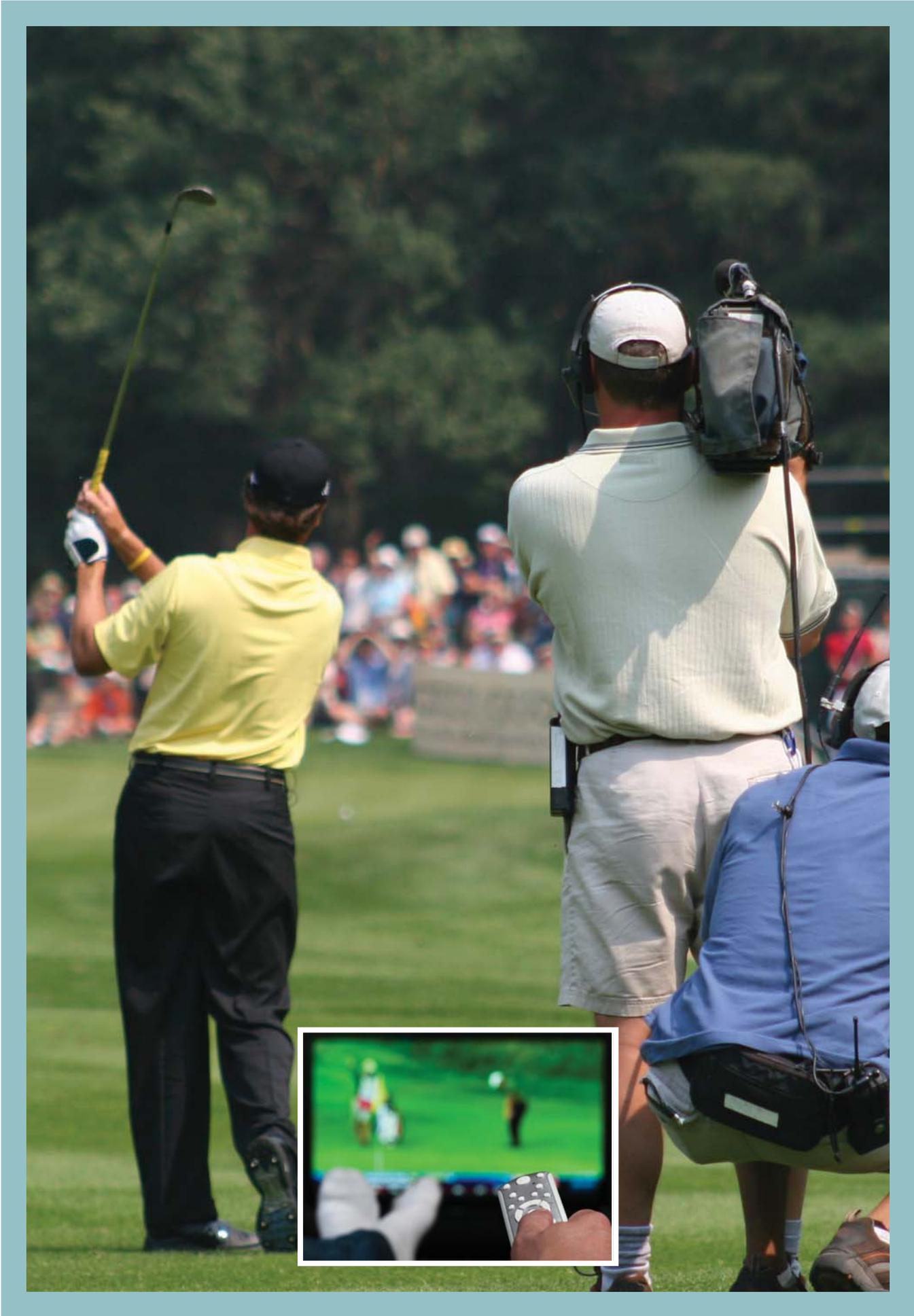
Source: BIS

- a) **Audit:** This activity consists of understanding what spectrum is held, how it is used and what the options are for releasing it in the future. For public sector spectrum holdings this work has now been substantially completed.
- b) **Clearance:** Very few spectrum bands are unused. Therefore, when a decision has been made to release a spectrum band there is often a need to clear some, or all, of the existing users from that spectrum band. This process does not necessarily imply that the services that currently use the band should cease.
- c) **Preparation for release:** These are all of the activities that need to be carried out before a band is reassigned to a new user, which can often be carried out in parallel with the clearance process. These include determining the technical conditions for the licence, international work, and determining the process by which the spectrum will be released. Depending on how the spectrum will be released it may also require Ofcom to make secondary legislation (e.g. if a department requires a grant of Recognised Spectrum Access (RSA)).
- d) **Award:** This is the process to release the spectrum and to determine to whom Ofcom should issue a licence, for example this could involve holding an auction or a comparative selection process.
- e) **Management:** There may still be issues that arise for Ofcom (and/or departments) as part of ongoing spectrum management after release, in particular with interference or as licensees come to the end of any initial term. As transition to alternative bands or efficiencies of use within existing bands can depend on available technology there will need to be ongoing engagement with technology and equipment manufacturers to understand future possibilities. Determining the right answers may require a new audit.

Costs of release

- 5.13 Preparing for spectrum release will normally incur costs, for example, as part of the business case development and assessment, equipment modification, consultation or running an auction. Preparing specific bands for release could require investment in new equipment that allows for more effective use of spectrum. Departments may also need to purchase new equipment in order to transition to another band or to operate within a more limited bandwidth.
- 5.14 A cost-benefit analysis will need to be completed on a band by band basis assessing the upfront costs of releasing the band and any additional costs (such as purchasing new equipment) incurred by departments or other parties, against the benefits of freeing the band. The benefits would include increased economic activity, social benefits derived from an alternative use, or any proceeds from sale.

Q2: We have described the issues that we see in releasing public sector spectrum holdings in section 5. Are there any other issues that we should consider?



Section 6: Strategy for release

Identifying and releasing spectrum

- 6.1 Taking account of the many competing demands, we intend to release spectrum where to do so will add most value and it is most practical to achieve. In broad terms, the process we will follow will be to expedite release by:
- Identifying key bands for release and focusing effort on them
 - Agreeing detailed processes for release in each band
 - Clarifying responsibilities for action
 - Setting a clear timetable against which we can monitor progress
- 6.2 We will also continue to put in place incentives, such as spectrum payments, for departments to use spectrum efficiently.

Criteria for identifying bands

- 6.3 In identifying bands for release from the public sector we will prioritise spectrum which:
- Is likely to meet demand and provides spectrum where it is most needed
 - Maximises value to the economy, through release to applications which will promote further investment and growth, and secures an appropriate return
 - Can be released quickly and easily, particularly bands where significant work has already been undertaken to facilitate release or those which are lightly used or have no international restrictions
 - Provides an appropriate balance between the costs of release and the benefits of use
- 6.4 These criteria will often be compatible. For example, during the time taken to secure agreement to a new international allocation, work can be carried out to clear a particular spectrum band of existing users.
- 6.5 As described previously, the public sector uses spectrum for a range of critical services. In considering the potential for release, clearance, or migration from a spectrum band, public safety and national security obligations will continue to be met.

Releasing spectrum to market

- 6.6 There are a number of ways that spectrum can be released to the market including outright sale of the rights or shorter or longer term leasing arrangements. Leasing arrangements may be appropriate as a temporary measure where spectrum is not yet ready for outright disposal or where there is a known future need. There may also be opportunities to share bands with other users or release spectrum on a regional basis. This may particularly suit bands that are lightly used, or only used in particular areas.
- 6.7 It may also be appropriate to release some spectrum on a licence-exempt basis. Licence-exempt equipment typically uses spectrum for applications operating in small areas, such as Wi-Fi and in certain areas or bands the proliferation of devices now places demands on the spectrum available. The final decision of whether to make equipment that uses a particular spectrum band licence-exempt would be for Ofcom.

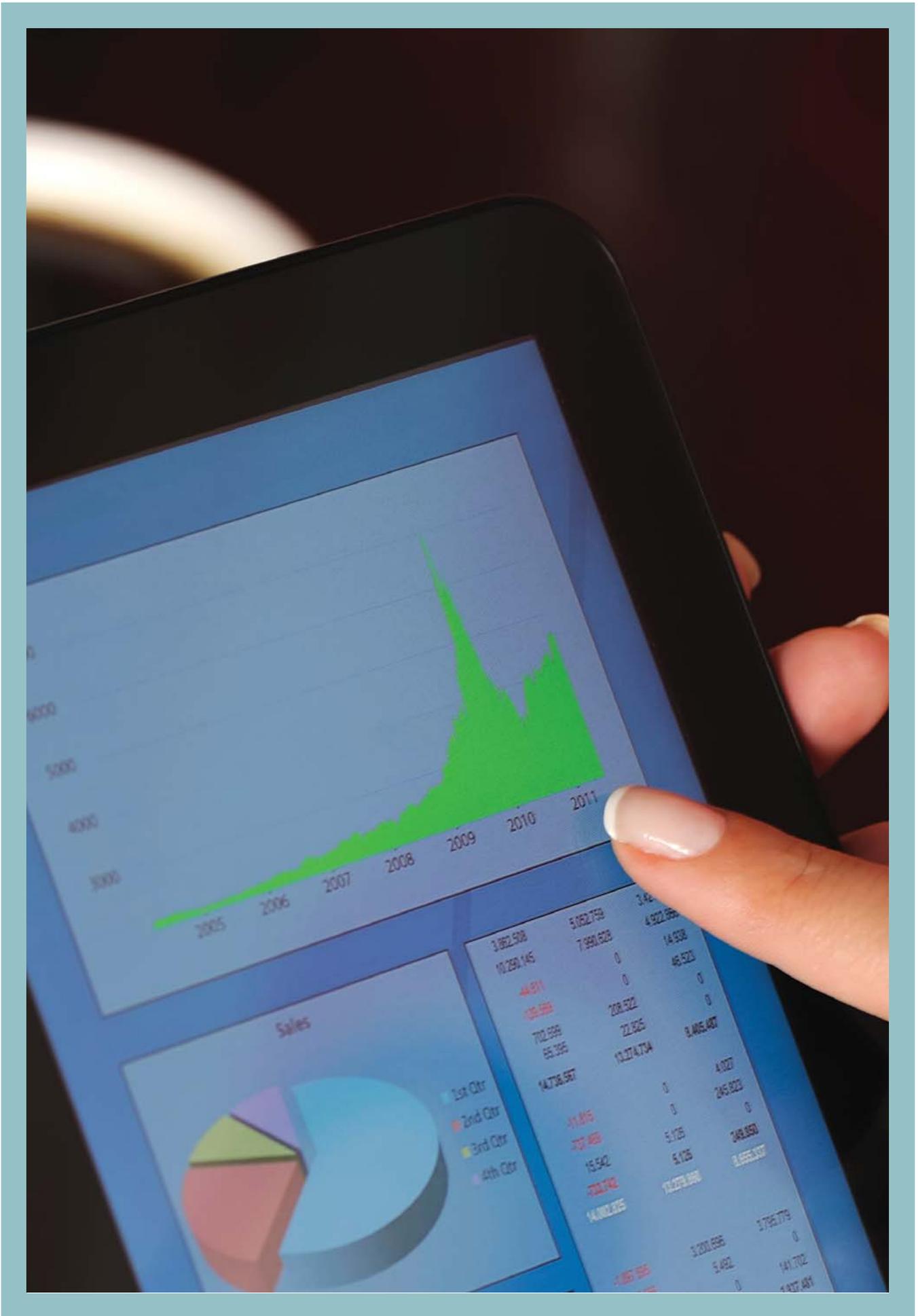
- 6.8 For public sector bodies to be able to trade spectrum a mechanism is required to assign the rights of use. This has been achieved by the creation of RSA which is managed by Ofcom.
- 6.9 In order for a private company to use spectrum they will need to have a licence issued by Ofcom which will in turn require Ofcom to convert the RSA to a licence. The licence will contain many of the standard terms and conditions of other Ofcom licences. In awarding a licence, Ofcom will need to apply criteria that are objective, transparent, non-discriminatory and proportionate. We believe that it will be important to give all those who may be interested in a particular spectrum band equal opportunity to acquire it.

Other incentives to release spectrum

- 6.10 Given the complexities involved in releasing spectrum, both in terms of project management and costs, existing users will need to be appropriately incentivised through mechanisms such as:
- Ensuring that departments recognise that there is a cost to holding spectrum and make spectrum payments that reflect market prices
 - Allowing departments to retain some of the receipts from anticipated spectrum releases
 - Funding of upfront costs for carrying out modification works or replacing existing equipment
- 6.11 We will consider how the current system of spectrum payments can be extended and agree with departments on a case-by-case basis how costs will be funded.

Coordination with civil spectrum releases

- 6.12 In general it is important to be able to provide as much certainty as possible to industry about upcoming spectrum releases. Release of public sector spectrum, particularly large, valuable bands such as those suitable for cellular mobile use, will necessarily involve careful coordination with other similar bands to be released by Ofcom. It will be important to ensure that potential buyers have the resources (financial and people) to be able to participate in an auction and that the results of one auction are known before commencing another.
- 6.13 As a result we will work with Ofcom to develop an overall release programme encompassing the work resulting from this initiative and Ofcom's own forward plan.

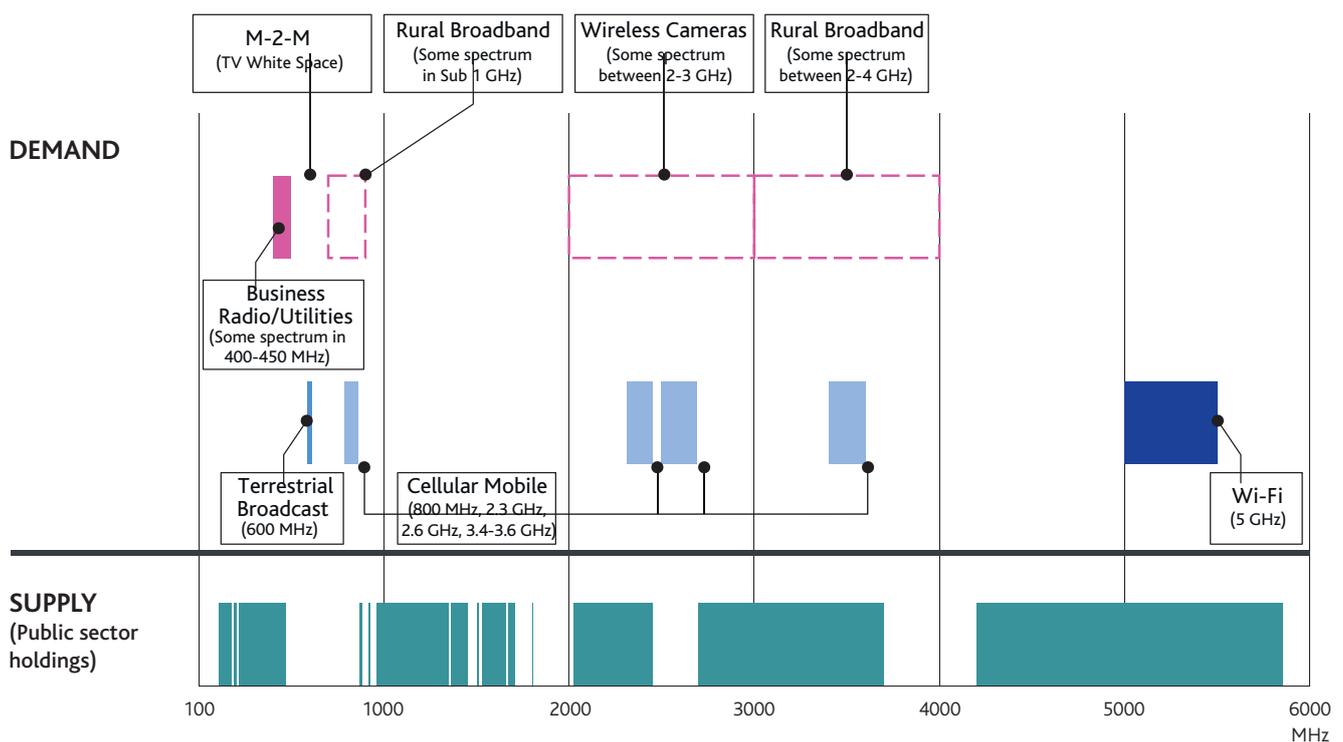


Section 7: Preliminary views on the 500 MHz

The process and rationale for identifying the specific bands

- 7.1 Below are the bands that we have short, and long, listed for where the 500 MHz is going to come from. The list is split into three groups:
 - The two bands we are currently prioritising for release
 - The three bands we have identified as priorities for further investigation
 - A list of bands for subsequent analysis
- 7.2 As is clear from the number of bands that we have identified we do not expect to release all, or even the majority, of these bands in the next 10 years. However based on the criteria in section 6 we believe that this is a suitable list.
- 7.3 On the supply side we have focused on the work referred to in section 3 that has already been done by the departments and others to identify those bands where it may be possible to free up spectrum.
- 7.4 In general terms the demand work has suggested that the highest demand is coming from mobile services and that by looking below 5 GHz we are looking in the right areas – and that, in general, the lower in the band the spectrum is, the more valuable it is likely to be. The discussions with industry have also suggested that harmonised bands have the highest value to them and that wider bands are of more use than narrower bands. A summary of how the supply and the demand analysis match against each other is shown in figure 11 below.

Figure 11: Supply of, and demand for, public sector spectrum holdings



Independent Audit of Spectrum Holdings, Departmental audits, Plum Consulting, BIS

- 7.5 While we have some of this supply and demand information, we do not yet have the full picture on all of the criteria that we noted in section 6, to decide if we should release any specific band. We will be doing further work on this in preparation for cost-benefit analysis to inform any decision to release a particular band and we would particularly welcome your thoughts as part of this call for evidence.
- 7.6 Issues and considerations with releasing bands have been considered in detail in section 5 of this document. However a number of areas that are particularly relevant at this stage are below.
- All spectrum bands are subject to international treaty. Additionally, in some bands, there are internationally agreed standards for services that use the bands. These agreements may need to be changed.
 - Much of the current analysis of the spectrum that it is possible to release has been based on desk based and theoretical analysis. As a result the possible release figures will need further work to validate and the actual release may be greater or less than indicated.
 - A number of these bands are shared with a variety of users. These issues will need to be considered when determining how much spectrum can be released, and under what conditions.

The bands currently prioritised for release

- 7.7 There are two spectrum bands that have been identified by the MoD as priorities for release. The potential release from within these bands together comprise 160 MHz of spectrum (i.e. around a third of the 500 MHz total). Those bands are shown in the table below.
- 7.8 These bands are still being looked at by the MoD to assess what might be possible to release, and what the costs of doing so might be. Once that work has been done it will be possible to carry out a cost-benefit analysis to decide whether to release that spectrum. Subject to this, our current expectation is that spectrum from these two bands will be available for release during the current spending round i.e. by March 2015.

Table 3: Bands currently prioritised for release

Band	Who	Total Bandwidth (MHz)
2310-2390 MHz	MoD	80
3400-3600 MHz	MoD	200

Source: MOD, BIS

- 7.9 From a demand side these bands are particularly valuable for mobile use as they are internationally harmonised. They have both been identified as initial candidate bands for consideration for release by the US¹⁴. The 3400-3600 MHz band and the 2300-2400 MHz band are identified worldwide for mobile services. The 3400-3600 MHz band is also part of a wider band that is the subject of a European Decision that harmonises the whole of the 3400-3800 MHz band in a way that is suitable for mobile use across Europe.
- 7.10 From the supply side these two bands were looked at as part of 2008 PA study. It is worth noting in particular that at 3400-3600 MHz the band is already shared with a number of users: NATO, the emergency services, programme making and special event licensees, radio amateurs and 40 MHz that has been licensed by Ofcom to UK Broadband for Wireless Broadband Access.

The bands that we will investigate first

- 7.11 We have also identified three bands which we are proposing that we focus on in order to identify further spectrum towards the 500 MHz target. These bands will need further analysis to identify how much can be released and what needs to be done to achieve release. However the latest analysis, some of which is several years old, suggests that there is a potential to release a further 526 MHz of spectrum from those bands. The bands are listed in the following table and described in more detail below.

¹⁴ All of 3400-3600 MHz band has been identified in the US with 3500-3650 MHz identified for Fast Track evaluation. From 2310 – 2390 MHz the US has specifically identified 2305-2320 MHz and 2345-2360 MHz as candidates.

Table 4: Bands we will investigate first

Band	Who	Total Bandwidth (MHz)
2700-3100 MHz	CAA / MoD / MCA	400
3100-3400 MHz	MoD	300
4400-5000 MHz	MoD	600

Source: MOD, DfT, BIS

2700-3100 MHz

- 7.12 This band is currently used for primary radars¹⁵ for aeronautical and maritime. MoD and the MCA use it in coordination with the CAA. One of the key reasons for having these radars is that they do not require assistance from any equipment on-board the aircraft. This band has been the subject of several studies since the recommendation for further work in the 2005 Independent Audit. A recent study suggested that:
 - Reassigning the frequencies of all the radars with no other changes could release up to 160 MHz
 - Migrating all air traffic radar to solid state in addition to complete re-assignment released a further 70 MHz
- 7.13 This is largely a theoretical study so further work now needs to be carried out to determine what is possible in practice. In particular there needs to be further work to look at what might be possible after the changes that are being made to the existing radars to ensure that the spectrum release at 2500-2690 MHz take place. To release 230 MHz would require all of the civil radars at 2700-2900 MHz to move, with the associated costs, so before deciding whether to do this, a cost-benefit analysis would need to be carried out.
- 7.14 It is worth noting that this band has also been identified as an initial candidate band for consideration for release in the US.

3100-3400 MHz

- 7.15 This band is used by military radars. It was identified in the PA study in 2008 for the MoD as having release potential. PA suggested up to 125 MHz of spectrum in this band could be released. Defence has relatively heavy use of this spectrum band in parts of the UK, but even if this use is protected there is the potential for release of much of this band across the rest of the UK. As above this has been identified as a candidate for release in the US.
- 7.16 This is a band where the MoD is carrying out further detailed work to understand the potential for release.

4400-5000 MHz

- 7.17 This band was originally identified as a candidate for release in the Independent Audit. This noted that the band “has been harmonised throughout NATO for military services. It is mainly used in the UK for fixed links between military establishments and contains many wide-band high capacity links for tactical area communications systems.”
- 7.18 Since then the MoD has done further work to look at this band and the 2008 PA study noted the potential to release 171 MHz of spectrum. It noted that there was particular hot-spot usage in certain areas, but that beyond that there was the potential to release this spectrum across the rest of the UK.
- 7.19 As with 3100-3400 MHz band this is a band where the MoD is doing further work.

¹⁵ These radars are ground-based and do not rely on transponders carried on aircraft or vessels.

The bands that we will investigate next

- 7.20 At this stage we are not certain exactly how much will be released from the bands identified above. While we will be focusing our attention on these bands it may be that further analysis shows that the total release from these bands will not meet the 500 MHz target, or that it will not be possible to release it by 2020. In addition there may be opportunities to release some narrower bands. As a result we have a longer list of bands that we are also planning to look at over the coming months and years.
- 7.21 In many cases this will involve commissioning of studies to better understand what spectrum, if any, might be available in these bands, and what might need to be done to release it.

Table 5: Bands above 1 GHz

Band	Who	Total bandwidth (MHz)	Note
960-1215 MHz	CAA	245	This band is used for a variety of systems and is the candidate band for the Future Communications Systems. Frequency management arrangements are complex and whilst further studies into potential release are warranted, safety requirements may limit any medium term releases. However, navigational system use in the band may reduce if ICAO aspirations on future GNSS employment are realised. Military systems also operate in this band under coordinated and harmonised arrangements with CAA.
1215-1350 MHz	CAA /MoD	135	Need to look at this in more detail to see if any release was possible here from replanning radars.
1375-1400 MHz paired with 1427-1452 MHz	MoD	50	
4200-4400 MHz	CAA	200	In the past there was an ITU recommendation to narrow the amount used by altimeters. Further work noted that this was all still needed until 2015 and the ITU recommendation was removed. Bandwidth for these systems is necessary to meet performance requirements. Any change would require a change in international requirements. This band has been identified as an initial candidate for release in the US.
From 5000-5250 MHz if it stops being used for MLS	CAA	250	This is outside the range and the band already accommodates a number of other users. However following work at the upcoming WRC this may be possible to release if it stops being used for MLS

Source: MOD, DfT, BIS

Bands below 1 GHz

7.22 Current studies suggest that there may also be opportunity to release spectrum within bands below 1 GHz.

Table 6: Bands below 1 GHz

Band	Who	Total Bandwidth (MHz)	Note
Multiple bands (below and above 1 GHz)	Emergency services, relevant departments and Ofcom	60 ¹⁶ Exclusive 95 ¹⁷ shared with MoD	The Home Departments are considering their future communication requirements after the Airwave contract ends. It is unlikely that any of the emergency services' exclusive radio spectrum will be released before 2013 when these considerations are expected to be completed, although there may be opportunities for some sharing before that.
380-399.9 MHz	MoD	19.9 ¹⁸	From 2008 PA study
401.5-406 MHz	MoD	4.5	From 2008 PA study – note Cospas-Sarsat use at 406-406.1 MHz
406.1-470 MHz	MoD / DfT	63.9	A number of bands within this have been identified by the DfT and in the 2008 PA Study. However much of this is already heavily used by Ofcom for business radio (and is valuable for that use). Note, as above, the adjacent Cospas-Sarsat use and that there is also amateur and radio astronomy use.
870-872 MHz with 915-917 MHz	MoD	4	May be suitable to be released as part of Ofcom's prospective award of 2 x 4 MHz of adjacent spectrum.

Source: MOD, DfT, HO, DCLG, BIS

7.23 As described in section 4 we have had some expressions of demand for these bands, particularly for the bands around 400 MHz that might be usable for business radio. In addition the 870-872 MHz with 915-917 MHz band may be relatively straightforward to release, and may have greater value to users if combined with the planned Ofcom release of adjacent spectrum than if it were awarded separately. Much of this spectrum may also be suitable to meet some of the expected future needs of the emergency services amongst other things.

7.24 Except for the consideration of the future emergency services' needs, at this stage we intend to focus our attention on the bands above 1 GHz where our initial market soundings suggest the demand lies. However we will look at the bands below 1 GHz to see where and how they can be released and would expect to see some releases from these bands during this 10 year programme. In particular we will look at all of these bands to see if there is anything that may be possible to release simply and quickly.

Q3: Are there spectrum bands that we have not mentioned in section 7 that you think we should consider for release?

Q4: Of the bands we have mentioned in section 7 which should we investigate first?

Q5: What would be an appropriate timing for releasing parts of those bands?

¹⁶ Within the British Islands 60 MHz of spectrum is currently reserved for exclusive emergency services' use. The list of bands that make up this total can be found in Annex I of the UK FAT.

¹⁷ The emergency services have access to 95 MHz of MoD spectrum in multiple bands below 5 GHz, subject to agreed sharing arrangements. In addition individual services may have additional access to MoD spectrum on a local or sub-national basis by special arrangement. Any release of this shared spectrum will be for the MoD to lead.

¹⁸ Part of the band is currently being used by emergency services and is included in the 60 MHz listed above.

Section 8: Conclusions and next steps

What happens next

- 8.1 In order to move the releases forward, and refine the list of bands, spectrum holding departments expect to carry out a number of activities over the next ten years. The first of these activities are described in this section.
- 8.2 This document calls for evidence in a number of areas to allow us to gain your views to help us refine our release plans. The call for evidence runs from 31 March 2011 to 23 June 2011 and is addressed to all interested parties. The questions are summarised in Annex 3 which also includes the details of how to respond.
- 8.3 We intend to publish an update in the autumn of 2011, incorporating the input from this call for evidence. This update will confirm the bands that we are going to focus our attention on and give further details of the next steps and milestones.
- 8.4 However in parallel with that, so as not to unnecessarily delay any release, we will be focusing our effort on key bands that we have identified in this document. The areas for immediate attention are below.
- The MoD is carrying out work to better understand the supply and demand issues at 2310-2390 MHz, 3400-3600 MHz and 4400-5000 MHz which they expect to complete in the spring.
 - Following on from the theoretical work that has already been carried out at 2700-2900 MHz the next step is to ascertain the feasibility of releasing this spectrum. DfT with support from the CAA, MCA and MoD will commission the further planning activity and testing work to do this, taking into account the work being done to enable the release of 2500-2690 MHz and considering the needs of the current users.
 - It is clear that in order to make this spectrum most useful we will need to carry out much international work e.g. to allocate a band for mobile internationally or to take forward the vision to increase the use of satellite technology in aviation. This international work has significant lead times. Therefore we, together with Ofcom, will need to determine rapidly what the UK's international goals for this spectrum should be.
 - As we have discussed earlier, communications for the emergency services are going through significant transition. Rapidly understanding their future requirements and in particular their spectrum requirements will be important, both to understand better what additional spectrum they may need – and so how it may impact upon other public sector releases – and to understand what spectrum they may be able to release.
- 8.5 However although these areas will be our focus we will not ignore other areas. In particular we will look at other areas where we may be able to release spectrum quickly, including prioritising the releases of narrower bands for which there is demand.

Monitoring and reporting against progress

- 8.6 We expect to publish regular updates on the progress of this work. This will include an update on the progress against any milestones for bands that have been identified for release and details of any new bands that we have identified. As discussed we expect the first of these updates to be in the autumn of 2011.
- 8.7 You should note that in addition to these updates, as spectrum-holding public bodies progress with the release plans for specific bands, they may be publishing detailed documents about these release themselves. The updates will serve to continue to provide an overview of the government release programme.

Q6: What actions do you think that we should be taking at this stage beyond those described in section 8?

Annex 1: References

Historical public sector spectrum holdings audits

1. Independent Audit of Spectrum Holdings by Professor Martin Cave for Her Majesty's Treasury (December 2005).
2. Independent Audit of Spectrum Holdings Government Response and Action Plan (March 2006)
3. Forward Look: A Strategy for Management of Major Public Sector Spectrum Holdings, BERR – UKSSC (April 2009, March 2007)
4. UK Defence Spectrum Management. A Consultation on: An-Implementation Plan for Reform, Ministry of Defence (May 2008)
5. Ministry of Defence Final Report Defence Demand for Spectrum: 2008-2027 by PA Consulting (November 2008)
6. UK Defence Spectrum Management, A Statement on: An Implementation Plan for Reform; Ministry of Defence (December 2008)

Other reports

1. Spectrum demand for non-government services 2005 – 2025 by Analysys Mason (September 2005)
2. Spectrum Requirements for the Next Generation of Mobile Networks, ngmn Alliance (June 2007)
3. Licence-Exception Framework Review by Ofcom (December 2007)
4. Predicting areas of spectrum shortage, PA Consulting for OfCom (April 2009)
5. Defence Spectrum Forecasting An Intellect Position Paper (November 2009)

Annex 2: Oversight of the release programme

- A2.1 In order to ensure delivery of the 500 MHz release we have put into place several levels of accountability and allocated suitable resource. This consists of direct ministerial responsibility, cross-government ministerial support to help resolve any issues, and suitable senior civil servant support to ensure progress is made on a day to day level.
- A2.2 The overall responsibility for delivering the 500 MHz target sits with the Minister for Culture, Communications and Creative Industries.
- A2.3 The Minister will report on progress to the Public Expenditure (Assets) Committee (PEX(A)). PEX(A) is the Cabinet sub-committee tasked with identifying new efficiencies, examining options for the potential sale of various government assets and looking at how to remove potential obstacles blocking any asset sales.
- A2.4 To support this work PEX(A) has created the Central Spectrum Release Group (CSRG). CSRG is a group of senior civil servants from all of the relevant departments that reports to PEX(A) via the Minister for Culture, Communications and Creative Industries. CSRG is chaired by the Chief Executive of the Shareholder Executive within BIS and has a mandate to deliver the 500 MHz. It also has the authority, via PEX(A), to require all departments to commit resources to these spectrum releases.

Annex 3: Call for evidence

A3.1 As we move forward with this 10 year programme, if appropriate, departments will look to run consultations ahead of the release of specific bands. However we are still in the process of refining our plans so we would welcome your views on any aspect of this document. At this stage we would particularly welcome responses to the following questions set out in this call for evidence.

Q1: What services do you think are most likely to demand spectrum from the public sector holdings between now and 2020 and when? Please provide evidence to support your answer.

Q2: We have described the issues that we see in releasing public sector spectrum holdings in section 5. Are there any other issues that we should consider?

Q3: Are there spectrum bands that we have not mentioned in section 7 that you think we should consider for release?

Q4: Of the bands we have mentioned in section 7 which should we investigate first?

Q5: What would be an appropriate timing for releasing parts of those bands?

Q6: What actions do you think that we should be taking at this stage beyond those described in section 8?

A3.2 This call for evidence starts on 31 March 2011 and will run for 12 weeks. We would welcome your views by midday on 23 June 2011. This is a public consultation and it is addressed at all interested parties. We would particularly views from current and prospective spectrum users. However, we also welcome views from others. All responses will be carefully considered.

Please send your comments, or if you have any queries about this call for evidence, to:

spectrum@culture.gsi.gov.uk

Or by post:

**Central Spectrum Release Group
Shareholder Executive, Department for Business Innovation & Skills
1 Victoria Street, London SW1H 0ET**

Freedom of information

A3.3 Please note responses may be published, unless you ask us not to do so. In addition under the Freedom of Information Act 2000 all information in responses, including personal information, may be subject to publication or disclosure. If any correspondent requests confidentiality this cannot be guaranteed, and will only be possible if considered appropriate under the legislation.

A3.4 For enquiries about the call for evidence (handling) process only please contact DCMS Public Engagement and Recognition Unit (PERU) at the above address or email enquiries@culture.gsi.gov.uk, heading your communication 'Call for evidence: Enabling UK growth – releasing public spectrum'.

Annex 4: Glossary

ADSL	Asymmetric Digital Subscriber Line (ADSL2 and ADSL2+ are related standards that allow faster speeds)
BIS	Department of Business Innovation and Skills
BPON	See PON
CAA	Civil Aviation Authority
CAGR	Compound Annual Growth Rate
CENELEC	European Committee for Electrotechnical Standardization
CEPT	European Conference of Postal and Telecommunications Administrations
CSRG	Central Spectrum Release Group
DCLG	Department of Communities and Local Government
DfT	Department for Transport
DSL	Digital Subscriber Line
DSM L3	Level 3 Dynamic Spectrum Management
EPSS	Emergency and Public Safety Services
GHz	Gigahertz
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
GPON	See PON
HD	High Definition
HO	Home Office
HSDPA	High-Speed Downlink Packet Access (HSDPA+ is an evolution that allows faster speeds)
HSDPA+	See HSDPA
ICAO	International Civil Aviation Organisation
IMT-2000	International Mobile Telecommunications-2000 (a set of standards for 3G mobile phones)
Independent Audit	The Independent Audit of Spectrum Holdings
ITU	International Telecommunications Union
LTE	Long Term Evolution (LTE-A is LTE Advanced, an enhancement of LTE)

LTE-A	See LTE
M-2-M	Machine to machine
MCA	Maritime and Coastguard Agency
MHz	Megahertz
MLS	Microwave Landing System
MoD	Ministry of Defence
NATO	North Atlantic Treaty Organization
NG PON1	See PON
Ofcom	Office of Communications
PEX (A)	Public Expenditure (Assets) Committee
PON	Passive Optical Network i.e. fibre (BPON, GPON, NG PON1, and WDM-PON are related standards that allow faster speeds)
RNSS	Radionavigation Satellite Service
RSA	Recognised Spectrum Access
Spectrum	references to “spectrum” in this document should be taken to mean radio spectrum
UK FAT	UK Frequency Allocation Table
UMTS	Universal Mobile Telecommunications System
VDSL	Very-high-bitrate DSL (VDSL2 is an evolution of VDSL)
VDSL2	See VDSL
WDM-PON	See PON
WRC	World Radio Conference

We can also provide documents
to meet the specific requirements
of people with disabilities.
Please call 020 7211 6200 or
email enquiries@culture.gov.uk

Department for Culture, Media and Sport
Printed in the UK on recycled paper
© Crown Copyright
March 2011



department for
culture, media
and sport

2-4 Cockspur Street
London SW1Y 5DH
www.culture.gov.uk

DCMS aims to improve the quality of life for all through cultural and sporting activities, support the pursuit of excellence, and champion the tourism, creative and leisure industries.