



UK Government
Investments

Public Sector Spectrum Release Programme

2nd Annual Report by UKGI Spectrum Central Management Unit

August 2017

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Foreword from Matt Hancock, Minister of State for Digital



Our use of Spectrum as a nation is an essential and integral part of our drive to grow the UK digital economy and the economy as a whole.

Demand for this precious asset is increasing, with new demands for faster, more reliable mobile data in urban and rural areas, on road and rail, safe driverless vehicles, the interconnectivity of machines and new generations of defence and public safety equipment.

These emerging demands need to be satisfied.

Spectrum will need to be made available for 5G services to ensure that the UK remains at the vanguard in Europe for the development and commercialisation of 5G services and technology. So the Public Sector Spectrum Release Programme matters. As announced, in the Budget in March 2017, the government will prioritise making available public sector spectrum for 5G, where there is a clear value for money case.

Spectrum is a finite resource and there can be no excuse for the either public or private sectors to use spectrum inefficiently.

Of course, the public sector needs some spectrum to deliver vital public services and protect the security of our citizens. These capabilities must be protected and maintained, but we have to be smarter and more innovative in how we deliver them to enable more spectrum to be made available for commercial use.

Achieving the targets set in 2016 continues to be challenging – spectrum is a highly complex and technical area and subject to international harmonisation agreements. We are on target to meet these targets through close co-operation and working between the spectrum using Departments and the Central Management Unit, supported by Ofcom, on technical and feasibility studies and by incentivising government users to improve their spectrum efficiency. We will also continue to assess what further public sector spectrum can be released or shared in the future to support economic growth.

There's been a lot of progress, but there is much more to do.

A handwritten signature in blue ink that reads "Matt Hancock". The signature is fluid and cursive.

Minister of State for Digital and Culture

Public Sector Spectrum Release Programme (PSSRP) Target

"750MHz of valuable public sector spectrum in bands under 10GHz will be made available by 2022, of which 500MHz will be made available by 2020."

Announced Budget 2016

Message from Mark Russell, Chief Executive, UK Government Investments



The CMU annual report charts the progress made on the Public Sector Spectrum Release Programme over the last 12 months.

Spectrum is vital to economic prosperity and the release of public sector spectrum will support the growth of the UK's digital economy. On top of this, the upcoming auction of 2.3GHz and 3.4GHz spectrum in 2017-18 will raise a welcome receipt for the Exchequer to support public finances.

The CMU is a small unit operating within UKGI, achieving results by drawing in expertise from Ofcom and spectrum using Departments. The work on the programme is an excellent example of collaborative working across government which is an important part of UKGI's service.

Sustaining progress over the next 12 months will be critical if we are to meet the government's targets by 2020 and 2022. I am confident that CMU will continue to drive the programme with the support of Ofcom, but spectrum-using departments must also play their part. Only by improving data capture amongst spectrum users, with clear Departmental accountability for assessments of continued and future use of spectrum, can we be sure that we will be able to meet the growing and diverse spectrum needs.

M. F. Russell

Mark Russell

Chief Executive, UK Government Investments

Central Management Unit (CMU)

The CMU is a small team in UK government Investments – a private limited company wholly owned by HM Treasury. It works collaboratively with government departments and Ofcom, utilising their respective areas of expertise, to identify and exploit opportunities for improving the management and efficiency of public sector spectrum use. To create momentum for this work, and ensure it delivers its remit to advance the government's key objectives set out in the Spectrum Strategy and the Productivity Plan 2015, the CMU's priority is to identify and explore the potential for release of high value spectrum bands currently used by the public sector for private sector use – either through band clearance, or sharing.

Executive Summary

The Public Sector Spectrum Release Programme (PSSRP) managed by the CMU continues to make good progress against both the 2020 and 2022 targets.

CMU's focus remains on the potential release (sharing or clearance) of spectrum where there is clear private sector demand, to support economic growth. These high value bands remain as identified in the first CMU report published in April 2016.

Good progress has been made in all priority bands set out in the 2016 report, to identify the systems and their characteristics that continue to be utilised in each band. For lower 2.300-2.350 GHz and 1427-1452 MHz, which are attractive to mobile network operators, feasibility studies are underway looking at how the Ministry of Defence (MOD) and Home Office (HO) systems operating in these bands can be protected if the spectrum were to be fully released or shared. The studies are expected to report to CMU during 2017.

For the first time, these studies have been funded through an abatement of Administered Incentive Pricing (AIP) approved by the CMU, under a delegation from the Treasury.

CMU has also made progress in other bands including understanding the future of shared access for emergency services equipment using TETRA or TETRA-like systems in the 380-385MHz and 390-395 MHz bands¹, and the possibility of access to parts of 406.2 to 430 MHz included in Ofcom's recent consultation on the potential future uses of the UHF1 and UHF2 bands².

Technical work on the sharing of 7.9-8.4 GHz used by the MOD is nearing completion and this spectrum is expected to be released early in 2017-18 for Fixed Link services.

The level of co-operation and collaborative working by public sector spectrum users involved in the PSSRP continues to be high. AIP, introduced to incentivise public sector users to use spectrum more effectively, has resulted in public sector spectrum being used more efficiently with potential future releases of spectrum. Although small, these changes mark an important and noticeable change in the mind-set of the public sector.

Despite this progress, achieving the targets continues to be challenging.

The historic patchwork of spectrum utilisation means that the ability of the public sector to release further bands of contiguous spectrum (particularly below 5GHz) is difficult to achieve without considerable costly remediation to ensure that there is no adverse impact on essential public services. Genuine trade-offs will be needed as we take the PSSRP forward which is why CMU introduced a mechanism to base decisions on full Cost Benefit Analysis – the first cases are expected to be lower 2.3 GHz and 1427 – 1452 MHz later in 2017.

¹ These bands are harmonised for NATO use and are considered to be Class A NATO priority which means that they are required for long-term strategic co-ordination/use.

² "Strategic Review of UHF Spectrum 420-470 MHz: UHF Bands 1 and 2"
<https://www.ofcom.org.uk/consultations-and-statements/category-1/420-470-mhz>

Public sector users are also looking at new ways to meet their spectrum needs and to share spectrum more effectively. Some Departments are already choosing commercial solutions to meet their needs meaning that spectrum already licensed for civil use is utilised.

There have been a number of significant market and policy developments in 2016-17, notably relating to 5G (e.g. the government's 5G strategy, Ofcom's 5G spectrum update and the National Infrastructure Commission's "Connected Infrastructure" report). The CMU will continue to monitor developments and take account of them in its activities.

Whilst the CMU is committed to achieving the government target to release 750MHz of valuable public sector spectrum in bands under 10GHz by 2022, 5G services will require the utilisation of frequencies above 10GHz (as well as lower frequencies to enable mobiles to connect to the core mobile network ("backhaul" services).

The public sector uses spectrum at these higher frequencies, for example for earth observation and military satellite services. The government will prioritise making spectrum used by the public sector available for 5G, where there is a clear value for money case. In view of this, and following on from the work carried out by Ofcom and decisions taken by the Radio Spectrum Committee; the government has already identified the 26.5-27.5 GHz band as a priority. MOD is working with Ofcom and the CMU to make this 1 GHz of spectrum available for civil use as a priority. The indications are that demand for additional spectrum for 5G services will be high, and the CMU expects to work with Ofcom to ensure that 5G spectrum is made available in the most appropriate and timely way.

Section 1: Introduction

This is the second annual report by the UKGI Spectrum Central Management Unit (CMU) which was established in the summer of 2015³.

The role of the CMU is to centralise the strategic coordination and oversight of publicly-held spectrum to better prioritise spectrum management and maximise the economic and social value of spectrum (while maintaining the public sector's operational effectiveness).

The first CMU report⁴ published in April 2016 set out the rationale for the revision of the government's target for the clearance or sharing of public sector spectrum. It highlighted the importance of the opportunities from the public sector sharing its spectrum with civil and other public sector users and set out several priority work streams for the next 3 years focussing on the release of the highest value bands (both economically and socially).

It also provided information on the governance of the CMU (included as Annex A to this Report).

This report provides an update on programme activities and wider developments over the past year and looks forward to future work in 2017-18.

³ CMU Terms of Reference

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/453242/Public_sector_spectrum_TOR_-_for_web_PDF_.pdf

⁴ "Enabling Growth – Public Sector Spectrum Release Programme" <https://www.gov.uk/government/publications/enabling-uk-growth-public-sector-spectrum-release-programme>

Section 2: Market and Policy Developments

The telecommunications and spectrum market together with the public policy framework have experienced several significant events over the course of 2016-17 which impact on the delivery of the PSSRP. Collectively, these developments signal a step-change in ambition for the UK in the growth of the digital economy and greater recognition of the importance of spectrum to achieve that ambition. These are the highlights:

1. Shaping the Policy Environment

a) Digital Economy Act 2017

The Digital Economy Act 2017 received Royal Assent in April 2017 and sets out the government's ambition to make the UK the most digital nation in the world. The Act contains a range of measures to enable world-class digital infrastructure in the UK, including providing a broadband universal service for UK; granting Ofcom additional information gathering powers and consumer switching and automatic compensation in relation to communication matters.

Specific spectrum measures designed to facilitate the development of the UK's digital infrastructure include:

- enabling Ofcom to register and regulate database providers so that it is better placed to undertake its spectrum management duties, prevent interference and help facilitate dynamic spectrum access; and
- allowing Ofcom to revoke (or vary) a spectrum licence or prosecute where there is contravention of a provision of the licence. In limited circumstances, Ofcom may impose financial penalties.

b) Brexit

The impact of Brexit on the PSSRP will be dependent on the terms of the future relationship with the EU. The UK is and will remain a member of CEPT (a body of 48 European regulators) which is responsible for developing European Common Proposals for World Radiocommunication Conferences. The UK will also remain a member of the International Telecommunications Union, the body of the UN that organises the World Radiocommunication Conferences. A report on Brexit and spectrum was prepared for the UK Spectrum Policy Forum (a forum brought together by techUK whose member companies range from leading FTSE 100 companies to new innovative start-ups) and was published in August 2016⁵.

c) Mobile Data Strategy update

In June 2016, Ofcom published an update to its Mobile Data Strategy⁶, providing stakeholders with information about market developments, and re-assessing priorities following the outcome of WRC-15. In October 2016, Ofcom proposed making available one of the bands identified in the Mobile Data

⁵ "Brexit – The Impact of the UK leaving the EU on UK Spectrum Policy" - https://www.techuk.org/index.php?option=com_techuksecurity&task=security.download&file=UKSPF_Y_BREXIT_The_impact_of_the_UK_leaving_the_EU_on_UK_spectrum_policy.pdf&id=9287&Itemid=181&return=aHR0cHM6Ly93d3cudGVjaHVrLm9yZy9pbmNpZ2h0cy9yZXBvcnRzL2l0ZW0vOTI4Ny1icmV4aXQtdGhlLWl0cGFjdC1vZi10aGUtdWstbGVhdmluZy10aGUtZXUt24tdWstc3BIY3RydW0tcG9saWN5

⁶ https://www.ofcom.org.uk/__data/assets/pdf_file/0033/79584/update-strategy-mobile-spectrum.pdf

Strategy, the 3.6 to 3.8 GHz band, for mobile services. The Mobile Data Strategy also set out Ofcom's current thinking on additional policies with regard to current users of the band that may enable more extensive availability for 5G/mobile going forwards. This consultation closed in December 2016, and Ofcom has since issued a statement and consultation about its approach to mobile services in this band.

d) Spectrum Sharing Framework

In April 2016, Ofcom formally adopted its Framework for spectrum sharing, which establishes the systematic approach Ofcom will take to assessing current and future opportunities for spectrum sharing. Ofcom applied this Framework to the 3.8 to 4.2 GHz band, which it believes has the potential for enhanced spectrum sharing. Stakeholders provided important evidence that allowed Ofcom to reach the preliminary conclusion that additional spectrum access could be authorised in this band on a geographically-defined basis.

e) Clearance of the 700MHz band

Ofcom continues to work on the clearance of this band in parallel with administering a grant scheme to fund the incremental costs of broadcasters exiting the band.

In November 2016, Ofcom confirmed it will work to accelerate the clearance programme by 18 months and release the 700 MHz band in potentially as early as mid-2020. The regulator also confirmed that 20 MHz of spectrum in the part of the 700 MHz band known as the 'centre gap', should be allocated for use by mobile data (specifically mobile downlink) but that the interim multiplexes may continue operating in this spectrum until at least 1 May 2020, or until mobile downlink services in this spectrum are deployed.

Ofcom is now working with government to prepare a consultation on a grant scheme to support users who will have to vacate the 700 MHz band earlier than expected. Ofcom's intention is to make this spectrum available for use by mobile network operators through an auction potentially taking place in late 2018 or 2019.

2. Enabling Infrastructure Delivery

f) "Connected Future"

"Connected Future"⁷ published by the National Infrastructure Commission (NIC) in December 2016 examined the infrastructure required for future digital connectivity to enable ultra-fast and ultra-reliable transmission of large amounts of data with super low time lags (latency). The report made several recommendations to government including ensuring that the necessary infrastructure for 5G is put in place across the UK's major centres and transport networks (i.e. major roads and key rail routes). The report recognised the link between spectrum policy and market economics in mobile communications and the expectation that 5G will require very high frequency millimetre wave radio spectrum resulting in very small cells.

g) The Government's 5G Strategy

DCMS and HM Treasury published the government's 5G strategy ("Next Generation Mobile Technologies: A 5G Strategy for the UK"⁸) as part of the March 2017 Budget. The strategy responded to

⁷ "Connected Future" - <https://www.gov.uk/government/publications/connected-future>

⁸ <https://www.gov.uk/government/publications/next-generation-mobile-technologies-a-5g-strategy-for-the-uk>

the NIC's report and recognised fully Ofcom's work on potential spectrum for 5G. The strategy builds on the government's Digital Strategy and Industrial Strategy and seeks to deliver three main outcomes:

- accelerating the deployment of 5G networks;
- maximising the productivity and efficiency benefits to the UK from 5G; and
- creating new opportunities for UK businesses at home and abroad, encouraging inward investment.

The Strategy incorporates several strands of activity. Specific initiatives include establishing a new centre of 5G expertise in DCMS to ensure that work across the UK to develop 5G capabilities is joined up in a way that meets the strategic objective of the nationally coordinated programme of 5G testbed facilities and application trials. As announced in the Autumn Statement 2016, the government will invest in this programme and up to £16m will be invested for a cutting edge facility to run the trials.

h) Development of potential bands for 5G spectrum

The Radio Spectrum Policy Group (RSPG), currently chaired by Ofcom, has published an opinion identifying 700 MHz, 3.4 to 3.8 GHz and 26 GHz as bands for 5G in Europe.⁹ Ofcom fully supports the RSPG opinion, and considers that the 26 GHz band, which has been identified as the "pioneer" band in millimetre wave frequencies, offers the most credible possibility to establish a global band for 5G ahead of WRC-19.

Following on from the RSPG's opinion, the Radio Spectrum Committee (RSC) agreed a Commission mandate to the European Conference of Postal and Telecommunications Administrations (CEPT) to develop harmonised technical conditions for spectrum in 3.4 to 3.8 GHz and 26 GHz in support of the introduction of 5G in the European Union.

In February 2017, Ofcom published an update on 5G spectrum in the UK.¹⁰ The document provides an overview of the international process that led to the identification of 700 MHz, 3.4 to 3.8 GHz and 26 GHz as bands for 5G in Europe, and sets out Ofcom's programme of work with regards to making these bands available.

The PSSRP will work closely with Ofcom and DCMS as proposals for 5G in the UK develop.

3. Enhancing Competition

i) Mobile Mergers & Evolution of the Market

In May 2016, the European Commission blocked the proposed acquisition of the O2 network by CK Hutchison (owners of the UK's "3" network). BT completed the acquisition of the EE network in August 2016. The UK mobile market, therefore, now comprises four networks – EE, O2, Three and Vodafone. This means that future releases of public sector spectrum will continue to be subject to competitive tension. Reflecting this, Ofcom has consulted on its planned approach for the auction of the released 2.3 GHz and 3.4 GHz spectrum.¹¹

⁹ http://rspg-spectrum.eu/wp-content/uploads/2013/05/RPSG16-032-Opinion_5G.pdf

¹⁰ https://www.ofcom.org.uk/__data/assets/pdf_file/0021/97023/5G-update-08022017.pdf

¹¹ https://www.ofcom.org.uk/__data/assets/pdf_file/0026/93545/award-of-the-spectrum-bands-consultation.pdf See sections 3 'Current State of the UK Mobile Market' and 4 'Competition Assessment'

UK consumer demand for mobile market service continues to grow:

	June 2016	June 2015	June 2014	June 2013	June 2012	March 2011
Active connections (millions)	83.6	83.7	83.2*	82.7	82.2	81.1
Total data downloaded/uploaded (GB, millions)	105.5	72.9	44.3	28.9	19.7	9.0
Data per active connection (GB)	1.26	0.87	0.53	0.35	0.24	0.11

Source: Ofcom analysis of Mobile Network Operator data, Connected Nations Reports 2011-2016¹².

The data traffic for England in June 2016 surpassed the data traffic for the whole UK in June 2015.

The data per active connection in June 2016 reached over 1GB for the first time – ten times the same figure in March 2011.

*Figure from March 2014

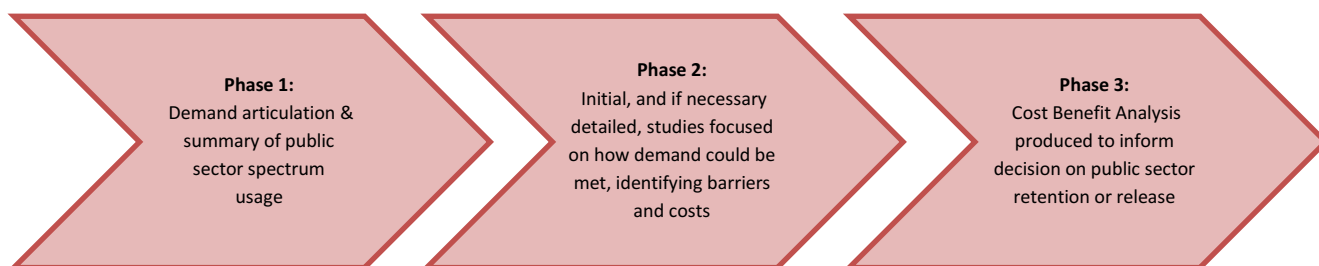
¹² Ofcom Connected Nations Report 2016 – <https://www.ofcom.org.uk/research-and-data/infrastructure-research/connected-nations-2016>

Section 3: PSSRP Progress since 2016 report

The PSSRP, led and managed by the CMU, continues to make progress against both the 2020 and 2022 targets. Since the establishment of the PSSRP in 2010, more than 384MHz of spectrum has been released by the public sector.

The CMU's priority areas of focus for the 2016-17 year were set out in its 2016 annual report prioritising those bands where potential release (sharing or clearance) of spectrum would support greater private sector demand, economic growth and/or improve services to consumers.

When considering the release of public sector spectrum, the CMU will follow this broad three phase approach:



On the conclusion of each study, the CMU will oversee the development of a Cost-Benefit Analysis (CBA), which will include an analysis of spectrum demand with underpinning facts provided by Ofcom, together with departments and other relevant expert sources.

These CBAs will set out whether, and how, the identified spectrum demand could be met, and what the costs of any remediation would be. All decisions will be evidence based; informed by the CBA, as approved by the CMU; and subject to collective approval by relevant Ministers.

Public sector spectrum can also be made available through more efficient and innovative use of spectrum by Departments including the sharing of public sector bands as well as the use of commercial providers to meet public service needs.

Priority Bands

The 2016 CMU report identified a number of priority bands currently used by the public sector for further investigation and consideration of their potential for clearance/sharing. These bands were considered by Ofcom to be the bands most valuable to private sector spectrum users and of immediate utility/commercialisation. Working Groups comprising representatives from the public sector spectrum users, a mix of departments (e.g. MOD, Home Office) and other public bodies (e.g. UK Space Agency, Meteorological Office), the CMU and Ofcom were established to evaluate the potential for spectrum release of spectrum in these bands and on what basis such release could be feasible. For lower 2.3 GHz and 1427-1452 MHz, which are attractive to mobile network operators, feasibility studies looking at how MOD and HO systems operating in these bands could be protected are underway.

The release of spectrum in these bands for either clearance or sharing will be subject to technical, feasibility and cost studies. The work is progressing well, in particular, on gathering information on the

public sector systems that exist and are used in the bands. A detailed look at the work on the priority bands is set out below:

Below 5GHz
380-385 MHz & 390-395 MHz
<p>These bands are harmonised for NATO use and considered a Class A NATO priority, meaning that they are required for long-term strategic coordination/use. Following discussions between NATO, MOD and Ofcom, the UK can continue to utilise the band for using TETRA or TETRA-like systems for emergency services.</p> <p>Ofcom’s consultation on the future use of the UHF 1&2 bands¹³ noted that compatible with NATO considerations, making these bands available for alternative emergency services and public safety uses will have a positive impact on the regulator’s ability to implement its UHF 1&2 policy proposals.</p> <p>The CMU, therefore, takes the view that further studies for this band are not necessary.</p>
406.2-430 MHz
<p>This band is used by a range of public and civil sectors including defence, emergency services, PMSE and PMR uses. Ofcom issued a consultation seeking responses on potential future uses for the UHF 1&2 bands (410-470 MHz). The consultation noted that the potential for increased sharing between the private sector and defence is to be assessed (although not on the same time frame as Ofcom implementing its UHF 1&2 proposals). The MOD will also continue to review the protection criteria for extant systems along with all stakeholders.</p> <p>Further work on this band will depend on the outcome of the technical work and will also take into account the responses to Ofcom’s consultation.</p> <p><i>NB Consideration of this band previously included 406.1MHz, use of this band is currently limited to protect emergency rescue satellite position-indicating beacons.</i></p>
960-1165 MHz
<p>Ofcom with the agreement of CAA and MOD has now made this band available for low power audio PSME use.</p>
1.4 GHz (1427-1452 MHz)
<p>The Working Group has identified the systems primarily operated by the MOD in this band including airborne telemetry and trunked radio relay. Some of these systems had relocated in the band to facilitate the release of upper 2.3GHz.</p> <p>Feasibility studies have been commissioned by CMU and MOD to identify what protections would be necessary to introduce sharing with existing MOD users. These studies will be available for consideration by CMU in summer 2017 and will be used, along with MOD’s assessments of the impact on defence capabilities and preliminary assessments of remediation costs and private sector demand to assess what further work should be undertaken on the potential release or sharing of this band. This is a high priority band for the PSSRP.</p>
Lower 2.3 GHz (2300-2350 MHz)

¹³ Add link to Ofcom consultation

The Working Group has identified the systems primarily operated by the MOD in this band including airborne and land-based telemetry, airborne data links, and mobile communications. As with 1.4GHz, some of these systems had relocated into this band to facilitate the release of upper 2.3GHz.

Feasibility studies were commissioned by CMU and MOD to identify what protections would be necessary to introduce sharing with existing MOD users. These studies will be available for consideration by CMU in summer 2017 and will be used, along with MOD's assessments of the impact on defence capabilities and preliminary assessments of remediation costs and private sector demand to assess what further work should be undertaken on the potential release or sharing of this band. This is a high priority band for the PSSRP.

4.8-4.9 GHz

Progress has been made in identifying MOD systems used in this band. This work is continuing but is assessed by CMU to be medium priority and so run behind the work on 1.4GHz and lower 2.3GHz.

CMU expects the Working Group for this band to be re-established in the course of 2017-18 to consider further work to identify civil demand for the band as well as what appropriate protections for military systems may be necessary.

Above 5GHz

5350-5470 MHz

Priority has been given to the higher 5GHz band (5725-5925MHz) as this band is already available in the UK for fixed wireless access on a shared basis.

5.8 GHz (5725-5850 MHz)

This band is primarily used for fixed satellite services, MOD radars, and amateur satellite services.

Ofcom consulted on the 5 GHz spectrum strategy in May 2016 ("Improving spectrum access for consumers in the 5 GHz band¹⁴") to understand the civil demand and opportunities. Discussions between UKSA, MOD and Ofcom are ongoing to understand the scope for widening the current sharing to allow greater access to this band, in particular for Wi-Fi in 2017-18.

7.9-8.4 GHz

At the time of the 2016 CMU report, technical work on the sharing of this band was already well advanced to allow additional capacity to existing fixed link bands across much of the south of the country. These arrangements will be refined through this year to ensure they do not impose unnecessary burdens on either MOD or future licensees.

CMU expects there will be opportunities for Fixed Link users to share this band with the MOD in 2017.

Public Sector to Public Sector Sharing

2.7-2.9 GHz

These bands are primarily used for civil and military radar. Given the technical characteristics of radars, CMU and Ofcom assess that this band is most suitable for public sector to public sector sharing.

¹⁴ <https://www.ofcom.org.uk/consultations-and-statements/category-1/5-GHz-Wi-Fi>

CMU continues to explore this, particularly with DfT as we are aware that investigations are underway to consider if the band could be used to support improved internet and mobile connections on trains.

As this work develops it is likely to require further input from the CAA, MOD and Ofcom to facilitate any sharing or release arrangements.

The CMU's highest priorities are to explore the potential for release or sharing of either or both of lower 2.3 GHz and 1.4 GHz given the high demand from mobile network operators (MNOs) for spectrum and the potential for their immediate commercial utility. The CMU has funded feasibility studies to look at protections for MOD systems in these bands for the first time through the abatement of AIP charges, providing a clear incentive and driver for Departments to progress work quickly.

As set out above, on the conclusion of each Working Group's activities and studies, the CMU will, if appropriate, oversee the development of a Cost-Benefit Analysis (CBA), which will include an analysis of spectrum demand with underpinning evidence provided by Ofcom, together with Departments and other relevant expert sources. These CBAs will set out whether, and how, the identified spectrum demand could be met, and what the costs would be (both in financial and capability terms) of any remediation. All decisions will be evidence based; informed by the CBA, as approved by the CMU; and subject to collective approval by relevant ministers. We will look at each band on a case by case basis. Where remediation costs are significant, these will be weighed against the economic (or wider public policy) advantages that release will bring. It remains possible that for some bands, the CBA may show that it is uneconomic to proceed with any kind of release, in which case we will remove it from our list of target bands.

Release of Upper 2.3 GHz and 3.4 GHz

This spectrum has been released by the MOD to Ofcom to be auctioned for mobile network services. Developments in the mobile market, such as the potential acquisition of O2 by Hutchison, delayed the auction of this spectrum but have now been resolved. Ofcom published a consultation on the rules for the auction in November 2016¹⁵ and the auction is due to be held later in 2017-18.

Other Activities

a) Dynamic Spectrum Access

In August 2016, MOD, CMU and Ofcom jointly hosted a workshop for industry to consider innovative approaches to enabling civil access to spectrum currently used exclusively by the public sector. The event was well attended and subsequent inputs from industry will be taken on board in future PSSRP work, with MOD continuing to investigate the potential for Dynamic Spectrum Access on a real-time basis – including drawing on experience in the defence Departments in the United States and France.

¹⁵ Award of the 2.3 and 3.4 GHz spectrum bands. Competition issues and auction regulations - https://www.ofcom.org.uk/consultations-and-statements/category-1/award-of-the-spectrum-bands?utm_source=updates&utm_campaign=award-of-the-spectrum-bands&utm_medium=email

b) Data Sharing

To support the PSSRP and support growth in the UK Digital economy, it is fundamentally necessary for the public sector to understand what spectrum it accesses and how it uses that spectrum. Only in this way can it be used efficiently. DCMS had previously initiated the UK Spectrum Data Sharing Project (UKSDSP) to assist this process and take forward the two commitments in the government's UK Spectrum Strategy¹⁶ and this has to some extent been taken forward by the revision of and improvements made to the Frequency Allocation Table (FAT) by Ofcom.

The CMU agreed to take on this work in July 2016 to look at the wider challenges involved in sharing data and has taken the opportunity to review the overall objectives to ensure that sponsoring Departments provide, and have access to, the information needed for good asset management and decision-making while recognising the need to maintain the security of certain information. As an initial step, the CMU, with Ofcom, has begun to pilot the data capture process with the Department for Transport.

c) Wi-Fi access on trains

The Department for Transport (DfT) is committed to rail passengers having better access to Wi-Fi during their journeys. There are a number of alternative approaches to delivering Wi-Fi on the trains. These include using existing mobile networks to deliver 4G mobile connectivity to the on-train Wi-Fi equipment, or using dedicated licensed or unlicensed spectrum to deliver high-speed connectivity between track and train.

Currently many Train Operating Companies are signing agreements with one or more mobile operators to deliver improved 4G mobile connectivity throughout passengers' journeys. Separately during 2017, there will be a trial using unlicensed spectrum to deliver up to 500 Mbps to the train. Other companies are also intending to conduct proof of concept trials / models using government licensed spectrum or unlicensed spectrum.

d) Changes in AIP payments

While only a small number of reductions in AIP have taken place in 2016-17, there is emerging evidence that AIP, introduced to incentivise public sector users to use spectrum more effectively, has resulted in public sector spectrum being used more efficiently with potential future releases of spectrum being forecast. These changes include:

- A switch of AIP from the Home Office to MOD in spectrum at 2302-2310 MHz, to reflect the Home Office's agreement to relinquish use of this spectrum; and
- A proposed adjustment to MOD's AIP of 50% to reflect the agreement to share spectrum with civil fixed links at 7.9-8.4 GHz when this spectrum is made available.

Other public sector users continue to review their spectrum holdings with a view to relinquishing spectrum and receiving AIP reductions.

¹⁶ "UK Spectrum Strategy" - <https://www.gov.uk/government/publications/spectrum-strategy>

Section 4: The Next 12 months

Over the next 12 months, the CMU will concentrate on 3 strands of work:

- a) Taking forward and reaching decisions on the feasibility and desirability of release of the priority bands, lower 2.3 GHz and 1427-1452 MHz;
- b) Supporting work on the development of the potential bands for 5G, including the release of public sector spectrum at 26.5 GHz and enabling future releases where necessary; and
- c) Working with Ofcom and our pilot department to understand the challenges and opportunities involved in enabling more effective sharing of spectrum usage data; improving the visibility of spectrum and spectrum usage in sponsoring Departments with the aims of making spectrum management a core element of procurement and asset management processes, and beginning to assess the challenges in forecasting future spectrum needs.

Priority Bands

The next 12 months will be crucial to delivery of the release targets as initial studies on the priority bands reach completion and decisions on next steps are taken.

The CMU expects to take definitive decisions on whether to continue to pursue work on the release of each of the bands during the year, and whether that release should be through clearance or sharing. We will work with the Departments currently using the bands, predominantly MOD, DCMS and Ofcom as well as HM Treasury.

The most significant decisions will be centred on the two bands where there is the highest demand from the private sector i.e. 2.3-2.35 GHz and 1427-1452 MHz. As set out in Section 3, initial feasibility studies are underway for these bands with initial reports to CMU due in mid-2017. Decisions will be made on further work in these bands (including whether further studies are required and the timing of proceeding to the Cost Benefit Analysis (CBA) to ensure that achieving the release target) remains on track.

Despite progress so far, achieving the targets remains challenging. The initial low hanging fruit has been picked (albeit that some of those releases involved significant technical work and remediation costs) and we are now looking at bands where the technical, feasibility issues and potential remediation costs are even more complex and significant. Genuine trade-offs will be needed as we take the PSSRP forward which is why decisions on release will be based on full CBAs.

Data Sharing and Forecasting Future Spectrum Needs

The CMU will complete its pilot with Ofcom and DfT with the aim of making recommendations to other Departments over the next 18 months. One of the CMU's preliminary conclusions based on detailed (and often, by necessity, separate) discussions with DfT road, maritime, rail and aviation policy leads, is that each Department would benefit from having a single point of expertise on Spectrum, such that it is able to take a coherent strategic view of its (and its agencies' and other bodies') present Spectrum holdings and future Spectrum needs.

The CMU intends to involve other Departments, notably the MOD and HO in the development of the pilot during the course of 2017-18 to understand the challenges and opportunities involved in enabling more effective sharing of spectrum usage data for the majority of public sector spectrum users. We will consider what information is required in addition to the information that already exists in the UK Frequency Allocation table.

Dynamic Spectrum Sharing: the 'Art of the Possible'

MOD has committed to continuing to develop its thinking and research into innovative and alternative forms of dynamic spectrum sharing. MOD intends to liaise closely with the US Department of Defence (DoD) and its contractors to assess the outcomes of DoD's current pilot and consider whether and how similar techniques could be applied in the UK to support efficient use and sharing of spectrum by MOD (and potentially wider application). This work will be fed into the PSSRP and the CMU will report back on the progress of MOD's research in its 2018 Annual Report.

5G

The use of 26 GHz (24.25-27.5 GHz) for 5G across Europe, and for future harmonisation at WRC19, has now been identified and the government has made the 26.5-27.5 GHz sub band a priority. The band is currently utilised by a mixture of civil and public sector users e.g. fixed links, earth observation and satellite services.

While this band is outside the PSSRP target, it will be important for the future of 5G in the UK, Europe and globally and to stimulate significant economic growth in terms of service and technology development. The MOD is working with the CMU and Ofcom to ensure the sub band 26.5-27.5 GHz is available for civil use as soon as is practicable.

Other bands, already listed as priority bands by the CMU at lower frequencies, will be needed for 5G to enable devices to connect to the core networks ("backhaul" services). These will form part of the PSSRP as needed during the course of 2017-18.

Next Annual Report

The CMU will issue a further progress report in its third Report which is expected to be published in April 2018. Significant developments may be subject to separate announcements during the year.

Table 1 – PSSRP Programme Progress and Priority Bands for Further Studies

Band	Lead Dept.	Target Release	Quantity (MHz)	Status
A: Completed Releases				
70.5-71.5 MHz 80-87.5 MHz 138.0875-138.1125 MHz 138.2875-138.3125 MHz	HO	2012	9	Released
1668-1670 MHz 1698-1700 MHz	HO	2012	4	Released
870-872 MHz 915-917 MHz	MOD	2014	4	Released
960-1164 MHz	CAA	2016	92	Shared
2025-2070 MHz	MOD	2015	45	Shared
Upper 2.3 GHz (2350-2390 MHz)	MOD	2015	40	Released
3.4 GHz (3410-3600 MHz)	MOD	2015	190	Released
Sub Total Released or Shared			384MHz	
B: Target Priority Bands below 5GHz				
380-385 MHz** 390-395 MHz	MOD	2021	Up to 10	Currently being used by Airwave. Emergency Services contract and licence expires in 2020. This is also a NATO Class A band. The UK can continue to utilise the band for using TETRA or TETRA-like systems for emergency services
406- 430 MHz	MOD	2018	Up to 5	Sharing - RSA
1427-1452 MHz**	MOD	2018	Up to 20	Identified globally as mobile broadband band MOD currently exploring opportunities for sharing within the band
Lower 2.3 GHz**	MOD / HO	2020 - 2022	Up to 40	MOD currently exploring opportunities for sharing within the band
4.8-4.9 GHz	MOD / HO	2017 – 2018	Up to 55	Possible use for broadband backhaul
Sub Total under 5GHz			Up to 500MHz (including Released)	
C: Priority Bands above 5GHz				
5350-5470 MHz 5850 – 5925 MHz	MOD / BIS / DfT	2017 - 2022	Up to 195	Dependent on ITU-R studies towards WRC19. Possible Wi-Fi or fixed link sharing
5725-5850 MHz	Ofcom	2017	Up to 125	Currently used for Wi-Fi outside of Europe, including in the USA and China. Ofcom is currently consulting on the technical regulations for making the band available for Wi-Fi.
7.9-8.4 GHz	MOD	2017	Up to 168	Feasibility work in advanced stage. Possible fixed links
D: Public Sector to Public Sector Sharing				
2.7-2.9 GHz***	CAA / DfT	2017 - 2020	Up to 100	DfT and CAA are currently exploring opportunities for public sector to public sector sharing within the band
E: Alternative Spectrum for Future Studies			Up to 200MHz	
TOTAL RELEASE AND SHARING TARGET BY 2022			Central Case 750MHz*	
F. 5G bands (above 10GHz)				

26.5-27.5GHz	MOD	tbd	1GHz	
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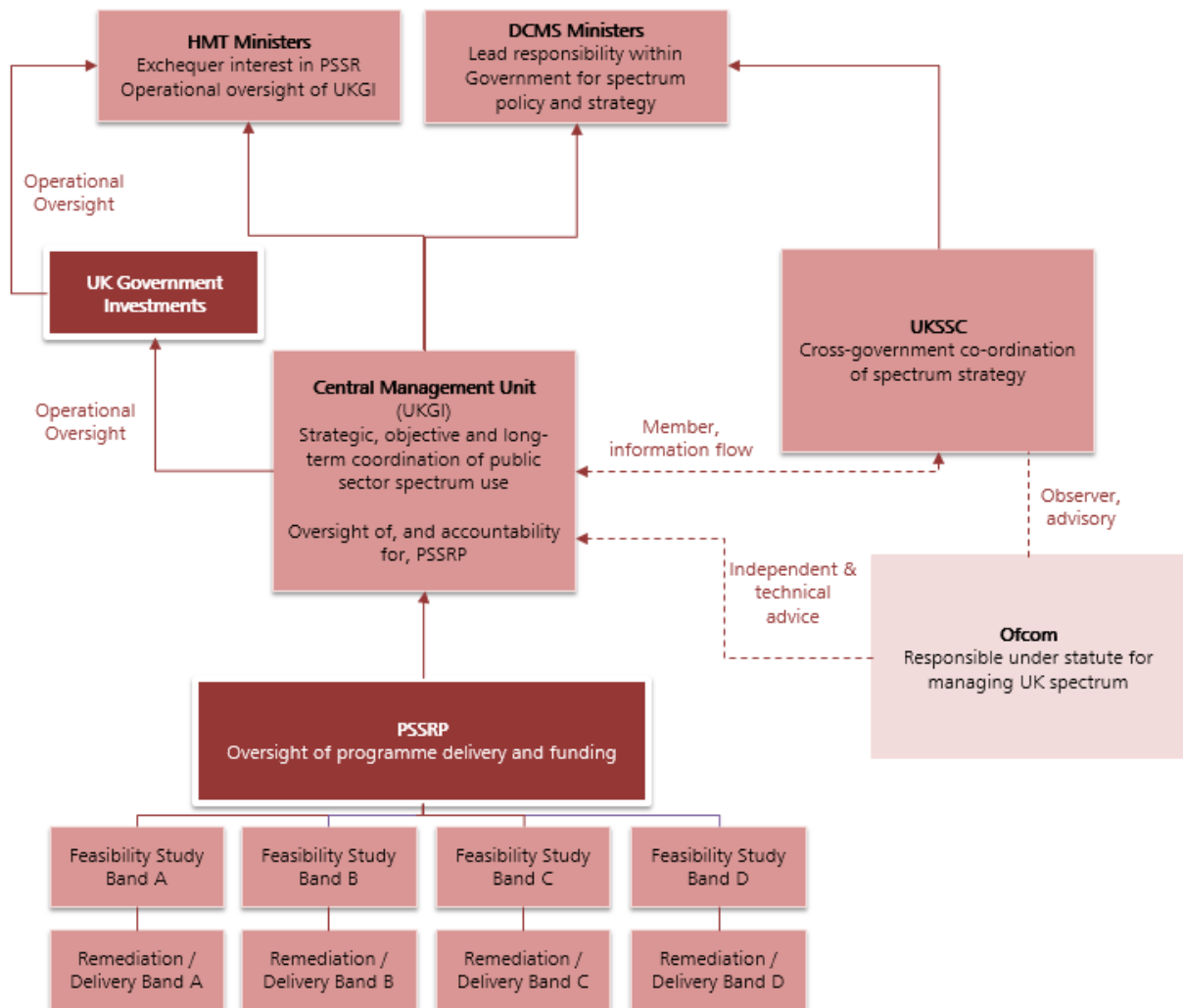
**The central case is the assessment of the CMU based on current information, subject to detailed band-by-band feasibility and technical studies, followed by cost-benefit analyses.*

***High priority bands' identified by Ofcom for release or sharing (as of March 2016).*

****Studies on the 2.7-2.9GHz band will focus on identifying opportunities for public sector to public sector sharing. Greater sharing between public sector users will not count towards the release target, but may be a key enabler if it unlocks opportunities for public sector users to migrate equipment into this band from other valuable bands that could then be released. Depending on the nature and extent of additional public sector uses in the band, greater public sector sharing would not rule out some sharing with civil users.*

Annex A

Graphic of Public Sector Spectrum Release Programme Governance



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