UK Government
Investments

Enabling UK growth:

Public Sector Spectrum Release Programme annual report

April 2016

UK Government
Investments

Enabling UK growth:

Public Sector Spectrum Release Programme annual report

April 2016

This publication is available at www.gov.uk/government/publications

PU1942

Contents

Foreword

Ed Vaizey, Minister for Culture and the Digital Economy

Spectrum is in many ways a hidden asset – we can't see it and we can't touch it. It is often taken for granted. But there is no doubt that it is a valuable asset. It is vital to the economic future of the UK, especially the delivery of digital communication services, and the continuation of essential public services such as defence, police and emergency services.

It is also a finite asset and that is why the government is determined that it should be used efficiently, for the benefit of consumers, businesses and the scientific community, as well as for the nation's security.

Since 2010 (when the Public Sector Spectrum Release Programme was established), good progress been made in releasing spectrum previously held by the public sector for the private sector to exploit – we have achieved almost 80% of the 2010 target in the first six years of the programme, a testament to the hard work and commitment of all public sector spectrum users.

In our manifesto, we committed to release more spectrum from public sector use to allow greater private sector access. In July 2015, we established the Central Management Unit to drive the release programme forward and in March 2016 we announced the new target set out in this report.

I welcome this revised and more ambitious target. It will not be easy to achieve, but with the commitment and determination of public sector users and favourable developments internationally, it is a target that is within our reach.

Ed Vaizey

Mark Russell, Chief Executive, UK Government Investments

The Central Management Unit (CMU) for spectrum is an integral part of the newly formed UK Government Investments (UKGI), a limited company wholly owned by HM Treasury that brings together the commercial skills, expertise and experience of the Shareholder Executive and UK Financial Investments. Our role is to offer impartial advice directly to the ministers and permanent secretaries of departments that own a particular asset or project – in this case spectrum.

Although the management of public sector spectrum is not typical of the work of UKGI – our core offering is to provide independent corporate finance and governance advice to government departments – the programme calls upon many of the skills we are renowned for: bringing departments together to facilitate delivery of high-priority, complex and cross-cutting projects. The wider focus of the spectrum programme is to generate value to the UK economy, but we also expect spectrum release to generate financial proceeds to the Exchequer.

This first report of the CMU establishes the roadmap in this Parliament, setting out a new and more ambitious target to release valuable spectrum to meet the demands of users and stimulate growth in services. UKGI is committed to the programme and to the delivery of the demanding targets that have been set. We are delighted to be able to play our part in facilitating the growth of the UK's digital economy.

Mark Russell

Executive summary

The Public Sector Spectrum Release Programme (PSSRP) has made good progress against the target set in 2010, releasing or sharing almost 80% of the high-value spectrum identified at the time, a testament to the hard work and commitment of public sector spectrum users, in particular those responsible for delivery at the Home Office, the Civil Aviation Authority (CAA) and Ministry of Defence. These releases have not been without their challenges, in particular the long time-scales required to complete feasibility studies and remediation work in order to offer spectrum to the market.

The CMU[1] was established in July 2015, charged with the strategic, objective and long-term coordination of public sector spectrum use. One of its first acts was to ask Ofcom to review the PSSRP, including the 2010 target to make 500 MHz of spectrum below 5 GHz available for civil users by 2020.

Ofcom has provided an assessment of civil demand, high value priority bands for release and / or sharing, recommendations for a revised target and views on how to deliver that target. In the light of Ofcom's report and following discussions with government departments, the CMU has proposed a new target, announced in the March 2016 Budget:

"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."

The target has several important components:

- **Release/sharing** is no longer limited to spectrum below 5 GHz, reflecting emerging demand for spectrum in higher bands since the original 2010 target was set.
- **An additional target for the release of a further 250 MHz of high-value spectrum below 10 GHz by 2022 has been introduced,** to reflect the increasing interest in use of higher frequencies e.g. for 5G mobile, fixed links, general backhaul - small cells and macro base stations, financial services and satellite.
- **The PSSRP will focus on the release of the highest value bands.** Studies in three 'high priority' bands (lower 2.3 GHz, 1427-1452 MHz and 380-385 paired with 390-395[2] MHz) have been initiated to determine the current uses, feasibility of release and cost of remediation (see Section 3). There will be no new public sector systems deployed in these 'high priority' bands while we carry out appropriate technical/demand studies.
- **The PSSRP will continue to support further sharing between public sector and civil users in other bands.** Ofcom recently announced sharing up to 92 MHz of the 960–1165 MHz band with PMSE users.[3] There is growing demand for fixed links, and up to 168 MHz of the 7.9 GHz band is being considered for possible sharing. Work on the 406 MHz and 4.8 GHz bands is underway and there will be a focus on encouraging the use of civil bands by public sector users (for services such as fixed links).

[1] The spectrum Central Management Unit (CMU) was established within the Shareholder Executive, now part of UK Government Investments. Working with departments and Ofcom, the CMU will develop and implement a clear, balanced approach to improving the efficiency of public sector spectrum use, releasing or sharing spectrum with private and public sector users whilst protecting current and future public sector capabilities.

[2] Currently used by Airwave for TETRA, UK 2 spectrum.

[3] http://stakeholders.ofcom.org.uk/consultations/new-spectrum-audio-PMSE/statement

- **The CMU will work with Ofcom to make better information available on usage and demand.** Underpinning all discussions about the efficient use of spectrum is the collection and maintenance of better information. The CMU acknowledges the work of Ofcom, DCMS and MoD in developing an interactive spectrum tool and establishing the UK Spectrum Data Sharing Project. This important piece of work will underpin the provision of better and more reliable data to the PSSRP and its long-term aim of improving the strategic and objective coordination of public sector spectrum use.

The CMU has focussed on a number of important enablers, of which the most important is funding. Incentives for departments to pursue feasibility and remediation studies swiftly are now better aligned, with the CMU able to direct cross-cutting studies paid for by departments from the abatement of Administered Incentive Pricing (AIP), a market-equivalent charging regime introduced for the public sector in 2014. When the CMU establishes a positive economic case for releasing a band, funding will need to be made available to cover remediation costs. Where departments are unable to meet some or all of these costs from within their budgets, they will need to apply to the Treasury at that stage for extraordinary funding if the spectrum is to be released.

Historically, departments have taken a very cautious approach to releasing spectrum, which is likely to have been driven in part by lack of knowledge about their long term spectrum needs – there may have been an incentive to retain spectrum on an indefinite basis, lest they have a future need for it. To mitigate these concerns and ensure they are not on obstacle to further programme progress, the CMU has agreed to work with the Department for Transport and its agencies with support from the MoD, to develop and pilot an approach for assessing future spectrum needs, with a view to rolling it out to all public sector users by 2018. At the same time, the CMU will work with Ofcom to better articulate private sector demand, to facilitate more robust strategic management of spectrum for all users.

The new target is intended to challenge public sector users to find new and innovative ways of contributing to the PSSRP, whilst being realistic about the necessity and continuing value of important public services. It is intended to be an ambitious target given the importance of the programme to UK digital economy. There are, however, a number of risks and dependencies:

1 **The CMU cannot say with certainty how likely or cost effective it is going to be to release or share a specific band by 2022 until studies are completed**. We will look at each band on a case by case basis, but there is the potential for remediation costs to be significant and these will be weighed against the economic (or wider public policy) advantages that release will bring. Detailed cost-benefit analyses (CBAs) will be prepared. For some bands, the CBA may show that it is uneconomic to proceed with release, in which case we will remove it from our list of target bands.

2 **A number of bands are subject to collective agreement – at both European and international levels**. The CMU's ability to release some target bands may be contingent on the outcome of the next World Radio Conference (WRC) in 2019. In addition, some of the most valuable bands have a significant NATO interest.

Finally, we address the issue of governance, which will be critical to the delivery of the programme (see Section 4). The CMU has strengthened programme governance, providing a forum where complex trade-offs can be considered in the round. The CMU will chair a Programme Board tasked with overseeing programme delivery, with membership including DCMS, HMT, Ofcom and spectrum-using departments. Its role includes:

- to commission and oversee feasibility studies on bands
- to oversee production of CBAs on the options for releasing or sharing individual bands (following completion of feasibility studies), which will be used to inform ministerial decisions and guide these through internal departmental approvals
- to oversee delivery of any remediation work necessary to effect the outcome of the CBAs
- to resolve trade-offs between public sector and private sector spectrum use at a strategic level

The government is clear that, in setting the new target, it does not endorse, or trade off, any release or sharing of spectrum that will result in a significant degradation of MoD or NATO operational capability, or of other key operational capability in the public sector. Within this context, it is expected that departments will follow the CMU's recommendations and decisions with regards to the most efficient use of spectrum. Where departments do not feel they can take forward the CMU's decisions or recommendations, or where there are tradeoffs to be made between financial and policy considerations (e.g. between time and cost of releasing a band), the CMU will recommend that DCMS ministers convene ministers from HMT and relevant spectrum-using departments to take collective government decisions.

1 Introduction

1.1 Increased use of electromagnetic spectrum is an important catalyst for innovation and growth of the digital economy as well as supporting national infrastructure, for example, through its use in aviation and weather forecasting. Spectrum is also used for scientific purposes such as astronomy and earth observation where demand may grow further in the future, e.g. remote sensing for climate change.

1.2 Technological advancements over the last few decades have already transformed the way we use and view spectrum. The use of mobiles and other connected devices are now an integral part of our lives and we depend on access to sufficient spectrum to meet our everyday needs. However, the nature of spectrum itself as a resource has not changed. It is finite and different parts of the spectrum are not freely interchangeable due to their differing physical characteristics.

1.3 The Public Sector Spectrum Release Programme (PSSRP), now entering its 6th year, has been working to deliver the government's commitment to get the best economic and social value for the UK from spectrum.[1] This includes exploring how the public sector can release spectrum without adversely impacting on important public services, such as defence capabilities and emergency services, and, where full clearance of a band is not possible, how sharing can be introduced and made more effective to meet private sector and users' demands.[2]

Central Management Unit (CMU)

1.4 The Productivity Plan,[3] published in July 2015, announced the government's intention to implement a new model for the centralised management of public sector spectrum. Following this announcement, the Central Management Unit (CMU) was established, and charged with the strategic, objective and long-term coordination of public sector spectrum use.[4] Work immediately began to establish the CMU, and its terms of reference were published together with confirmation that the unit would be set up in the Shareholder Executive (ShEx) in the Department for Business, Innovation and Skills.

1.5 ShEx, along with UK Financial Investments, is now part of UK Government Investments (UKGI), a standalone company wholly owned by HM Treasury. UKGI became operational on 1 April 2016 and has been established to provide independent corporate finance, commercial and governance advice to government departments.

1.6 The CMU is a small team in UKGI. 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[5] and the Productivity Plan, the CMU's priority in 2016 is to identify and

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/287994/UK_Spectrum_Strategy_FINAL.pdf

[2] the term "release" is used in this document – including in relation to the new target – to refer both to (i) **clearance and 'full release' of a band** for civil use; and (ii) **partial release or 'sharing'** of a band, where this allows for the majority of forecast civil demand to be met. Further detail on this distinction is set out in the Spectrum Sharing section in Chapter 3.

[3] https://www.gov.uk/government/publications/fixing-the-foundations-creating-a-more-prosperous-nation

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

[5] The UK Spectrum Strategy – delivering the best value from spectrum for the UK, DCMS, March 2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/287994/UK_Spectrum_Strategy_FINAL.pdf

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.

1.7 The staffing and structure of the CMU is kept under review to ensure that it has sufficient resource to meet its aims and objectives. This is our first report and we intend to publish progress reports annually.

1.8 The contents of this report are the result of extensive discussions with government departments and other public sector bodies that utilise spectrum. The CMU welcomes the co-operative and collaborative nature of these discussions and the commitment of these bodies to this important agenda.

The UK Spectrum Strategy

1.9 In 2010, the government set a target to release 500MHz of spectrum under 5GHz by 2020. This was recognised at the time as challenging, but public sector users of spectrum made a commitment to deliver the target. That commitment was reconfirmed, with plans to set a new target, through the Productivity Plan and the creation of the Central Management Unit in July 2015.

1.10 Through the programme, good progress has been made towards achieving the target and details of this progress are set out in Section 2: Progress to date. In addition to band clearance and sharing, the programme has stimulated more efficient use of public spectrum and created the possibility of new opportunities for departments to share with other public sector users and with the private sector.

Box 1.A: Example of the potential for spectrum sharing

Ministry of Defence managed spectrum is routinely shared with Programme Makers and Special Events. In June 2015 the MoD helped enable access to spectrum for the use of video, voice and data around Silverstone for the Grand Prix including pit to car and, with assistance from the CAA, weather radar. A 400 million world-wide television audience had their viewing experience enhanced from in-car video and voice recordings, and F1 team mechanics were able to change to wet weather tyres following accurate rain fall predictions. Car sensors transmitted up to 1,000 times a second with data sent wirelessly from car to pit, providing around 1.5 billion samples of data from each race.

1.11 In March 2014, DCMS published its UK Spectrum Strategy. This report does not propose any changes to the policy set out in that document, other than establishing a new target. The strategy set out in the 2014 document is even more valid given the increasing use of mobile communications and other devices that need to use spectrum.

1.12 The strategy set out the government's "vision for the use of spectrum to double its annual contribution to the economy by 2025 by offering business the access it needs to innovate and grow, and everyone in the UK the services they need to live their lives to the full". The report by Analysys Mason published by government in 2012[6] estimated that spectrum contributed at least £52 billion to the economy in 2011 (excluding the contribution public sector spectrum use made to the UK as a whole). The government has not yet commissioned further external analysis of the contribution that spectrum makes, but will consider providing an update in future reports

[6] https://www.gov.uk/government/publications/impact-of-radio-spectrum-on-the-uk-economy-and-factors-influencing-future-spectrum-demand

as the programme develops and more spectrum becomes available for private sector exploitation (for example through the auction of the 2.3GHz and 3.4GHz bands expected later this year).

1.13 When considering the value of spectrum, the government also needs to consider its social value. DCMS published a report on 'Incorporating the Social Value of Spectrum in Allocation Decisions' in November 2015.[7] This document proposed methods of evaluating the social use of spectrum that may be useful to the CMU in assessing the case for some spectrum use changes along with other factors.

1.14 The future use of spectrum by both the public and private sectors will be driven in part by technological advances. For example, new, flexible, more efficient equipment may allow the use of smaller bandwidths that could not previously be usefully utilised and the development of dynamic spectrum access (DSA) will allow flexible sharing opportunities on a geographical and time basis.

1.15 International developments will also open up opportunities as the World Radio Conference (WRC) reaches consensus on the specific uses of bands, which will lead to greater harmonisation on a global basis. This will tackle technical issues and enable users of spectrum to benefit from economies of scale in manufacturing, enable the free circulation of equipment; and facilitate a global harmonisation of band use, e.g. for mobile, space and aviation. It is important to recognise that the international harmonisation process can also constrain the progress of the release programme. The WRC meets at four yearly intervals, with its next gathering expected to take place in late 2019.

[7] https://www.gov.uk/government/publications/incorporating-social-value-into-spectrum-allocation-decisions

2 Progress to date

The 2010 target – release of 500MHz under 5GHz

2.1 Since 2010, government departments, in particular the Ministry of Defence and the Home Office, have made important contributions towards delivering the target, with almost 80% of the target achieved. These successes have been the result of complex feasibility and technical work and the transfer of costly and complex services from one band to another to free-up spectrum for release. This work has enabled the release (both band clearance and sharing) of spectrum and will contribute towards future studies as well as improving the public sector's knowledge base and capability:

2.2 The programme has secured the release of a total of 384 MHz of spectrum under 5GHz. These releases are a combination of band/part-band clearance and sharing – 247MHz and 137MHz respectively (see Table 1):

- Upper 2.3GHz and 3.4GHz have been released by the Ministry of Defence to Ofcom and will be subject to an auction expected later this year. These bands have been effectively cleared although some public sector use in them remains subject to ongoing protections.
- Spectrum is being routinely shared in 2025-2070MHz. In addition to public sector users, Programme Making and Special Events (PMSE) now routinely access this spectrum, for example, in support of high profile sporting events and music festivals.
- In March 2016 Ofcom announced that Audio PMSE users would be able to share access to the 960-1164 MHz band with aeronautical radio navigation services.
- The Civil Aviation Authority (on behalf of the Department for Transport) has completed the first phase of its research project to examine the feasibility of generating efficiencies of around 100MHz of spectrum from 2.7 – 2.9GHz currently used for military and civil aviation radars.

Establishing a new release target: the enablers for driving further progress

Administered Incentive Pricing (AIP)

2.3 Financial incentives are critical in the public sector as well as in the private sector. The private sector has traditionally paid for its spectrum use through licence fees (albeit that some spectrum is made available for general licence-exempt use, such as Wi-Fi, at no charge). One of the actions from the UK Spectrum Strategy was to introduce a mechanism for all government departments to pay for the spectrum they need on a market-equivalent basis as an incentive for them to release spectrum they do not require. AIP is the mechanism to calculate public sector spectrum fees, introduced for all departments during 2015-16.

2.4 AIP charges are tiered to reflect differing levels of private sector demand and the opportunity cost of continuing public sector use in a given band. This mechanism is intended to incentivise departments to release valuable spectrum they do not need thereby reducing AIP charges. AIP charges are set by HMT based on market data provided by Ofcom and advice from the CMU. The CMU is empowered to increase AIP charges on the most valuable bands.

2.5 From 2016-17, AIP charges were specifically included in the Comprehensive Spending Review Settlement letters for each department and fully reflect actual spectrum use (including any spectrum reserved for potential future use), thereby removing residual elements of cross-subsidisation from previous years' charging allocations.

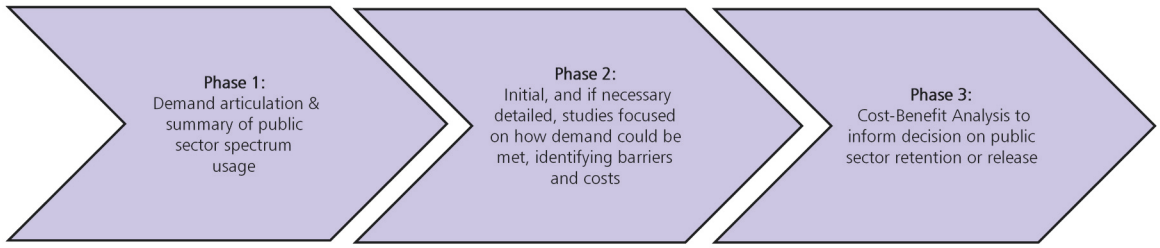
Funding for feasibility and technical studies

2.6 Technical studies to examine the barriers and enablers to release or share a specific band can be complex and expensive. In some instances, the absence of an agreed cross-government funding mechanism has held back departments from taking work forward, particularly where the benefit may not sit with the funding department. Most of the CMU's priority bands for study involve several departments or agencies, which historically has led to a confused picture in the past about who should fund studies and follow up activities.

2.7 Following the outline agreement contained in its Terms of Reference, the CMU has agreed with HM Treasury a new arrangement whereby the CMU will have responsibility for commissioning these feasibility and technical studies, working closely with Ofcom and all of the relevant spectrum-using departments and agencies. It is expected that departments will provide up-front funding for most or all studies, but they will be reimbursed through a commensurate abatement of their AIP charge. If a band is used by several departments then the abatement could be spread across those departments. It will be CMU's decision on whether, and by how much, a departments' AIP is abated.

2.8 The CMU will work with both Ofcom and departments to develop and agree terms of reference for work in each band, which in many cases are expected to take place in multiple phases.

Figure 2.A: Illustrative graphic of phases of feasibility studies



2.9 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.

2.10 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.

UK Spectrum Data Sharing Project (UKSDSP)

2.11 Initiated by DCMS at the request of UK Spectrum Strategy Committee (UKSSC), the UKSDSP aims to provide Ofcom and the CMU with an up-to-date picture of radio spectrum utilisation across the public sector. Delivering on the commitment within the 2014 UK Spectrum Strategy, the project is expected to underpin effective decision making by Ofcom, the CMU and departments as well as contributing baseline information to help deliver the release target.

2.12 While the initial phase of the project is focussed on collating internal government / Ofcom held data, opportunities may exist in future to combine this with other data sets held by Ofcom to produce an overall picture of spectrum utilisation which could be shared more widely, subject to security classification controls.

2.13 Subject to cross-government agreement, the current goal is for initial operational capability by the end of Q2 2016, supported by an effective technical solution and a Memorandum of Understanding between government and Ofcom providing re-assurance to ministers around data protection, data security and other issues.

3 Setting a new release target

3.1 Demand for spectrum within different sectors changes over time as technology advances and consumers' needs change. Sometimes, new technology means that less spectrum is needed to deliver the same service, such as with developments in digital broadcasting. More often though, increased technical capability fuels greater demand for services, which in turn drives greater demand for spectrum.

3.2 We have made good progress towards the current target but, as departments' work progresses and we gain a clearer idea of how civil demand has evolved since 2010, including in bands above 5GHz, it is appropriate to review the target. The target will be kept under review to ensure it is realistic but also challenging in an ever changing technical and economic marketplace.

3.3 The target is set at a level that incentivises all parties to deliver the PSSRP, but it also needs to be sufficiently flexible to enable current users to protect or enhance their existing capability in order to meet policy and operational needs. The target takes account of the value of spectrum, which is a complex assessment. Where publicly held spectrum is considered for release, the deliberations are based on robust cost-benefit analysis of the benefits to the private sector (and the wider economy) and the impact on the public sector in terms of cost and capability.

3.4 The CMU, following discussions with departments and advice from Ofcom considers that the target should be reset to: **"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."**

3.5 Government has collectively signed up to this target and confirmed that the priority is to release spectrum that is considered to be of high value to the private sector, i.e. where there is currently the most demand.

3.6 The achievement of this target is not a formality. It is subject to complex technical studies on the feasibility and costs of any change, will need to permit ongoing public sector capabilities to be developed and retained, and will be influenced by decisions taken internationally, for example at the next World Radio Conference in 2019. The PSSRP will help to inform the UK's priorities and negotiating strategy at future Conferences.

3.7 The target is, and is intended to be, ambitious, but one that the CMU believes is credible in the light of market demand and one that can be achieved. Importantly, it is a target departments have committed to play their part in delivering. In particular, the timescale of delivering by 2022 is stretching, given that decisions to release individual bands will be subject to positive results from feasibility and – potentially – technical studies, and demonstration of a positive economic case (following cost-benefit analysis) for timely remediation. Moreover, the Programme overall continues to remain subject to external factors, including unforeseen developments in civil or public sector demand for different bands (e.g. driven by technology advances or new operational requirements), and also international developments such as the World Radio Conference in 2019.

3.8 The CMU will report annually on progress towards achieving the target and where necessary reflect public sector, market, technological and international developments and their impact on the programme.

Spectrum sharing

3.9 As public sector spectrum use has – and will continue to – become more efficient and as the development of new technology and applications is likely in many cases to lead to an increased demand for public sector spectrum use, it will become increasingly difficult to identify further opportunities for full release of bands. It is therefore important that we explore opportunities for sharing between public sector and civil users, and between multiple public sector users, as well as for full release.

3.10 To explore how sharing could best work in practice, Ofcom has recently consulted on a framework for looking at sharing opportunities,[1] which focuses on how sharing can be facilitated without adversely impacting on the rights of existing users. Ofcom advises that "sharing spectrum between different users – either geographically, or between different services that can coexist – or in time – is already happening in many bands and can offer huge benefits."[2]

3.11 The CMU has worked with Ofcom and departments to define sharing for the purposes of the PSSRP, with the International Telecommunications Union interpretation a useful starting point: "…utilization of the radio spectrum is dependent upon frequency, time, geography (spatial location), and technology (for example for mobile services: modulation/coding and orthogonal signal separation). Any sharing of the spectrum has to take into account one or more of these four dimensions."[3]

3.12 **For the purposes of the programme, bandwidth will count as shared – and score 100% towards the target – where the public sector user(s) releases sufficient spectrum to Ofcom for the majority of forecast civil demand to be met at the time the spectrum is released for sharing.** As the nature of use and demand will vary across bands, decisions on scoring will need to be taken on a case-by-case basis by the CMU, informed by Ofcom's forecast of market demand and proposed residual public sector uses and protections.[4]

3.13 To ensure a balanced approach is taken between creating incentives for departments to release spectrum and enabling them to protect legitimate ongoing usage needs (and acquire spectrum for future needs), while ensuring shared spectrum is of value to prospective civil users, the following principles will govern the CMU's approach to sharing (including decisions on how it will be scored and future AIP charges):

- A public sector user may in some cases retain significant ongoing use and protections (whereas, for a band to count as fully released, residual restrictions will be more be limited in nature).
- If, after making spectrum available for sharing, the public sector user identifies new needs that can no longer be met, it should follow established Ofcom processes for requesting suitable spectrum.[5]
- The terms of Ofcom licenses to civil users in shared bands will be on similar terms to existing civil licences for that application and reflect the nature of demand. For example, it is likely that licenses for mobile broadband use will be long term and renewable, due to the significant investment and certainty required, while it is expected that licenses for PMSE use will be more limited in duration and scope.

[1] http://stakeholders.ofcom.org.uk/consultations/spectrum-sharing-framework/

[2] *Review of Public Sector Spectrum Release (PSSR): Recommendations to Government on the setting of a revised PSSR target*, Ofcom, March 2016, published on UKGI's website (https://www.gov.uk/government/organisations/uk-government-investments)

[3] https://www.itu.int/en/Pages/default.aspx

[4] The scoring framework may need to be reviewed in the longer term to reflect the changing nature of demand over time.

[5] As set out in Section 4: Programme Governance and in the CMU Terms of Reference, the CMU will convene a ministerial level 'Panel' to resolve any trade-offs.

Equally, the public sector user(s) will have access to the same level of commitment to its usage (of the non-shared part of the band) as will a licensed user (e.g. it will be entitled to long term usage if significant investment or commitment is required, and where this accords with departments' long term spectrum needs' forecasts).

- AIP charges will be abated if some or all forecast civil demand is met through the sharing arrangement. A reduced charge will still apply if some demand cannot be met due to ongoing public sector use.

Sharing between public sector users

3.14 Applying a strategic approach to public sector spectrum usage, supported by robust data, provides opportunity for organised consolidation of public sector spectrum use. For example, the CMU has determined, post WRC15 that the 2.7GHz – 2.9GHz bands, while potentially attractive to the private sector, are likely best designated for public sector sharing (this does not, however, rule out any private sector sharing in this band).

3.15 The CMU is considering the merits and scope of possible technical studies to explore how this spectrum could be best organised to further our objective of efficiently consolidating public sector spectrum usage, for example via migrating other public sector users into this band to facilitate other spectrum releases.

3.16 The ability of the CMU to fund these studies, along the with fact that departments will benefit from lower AIP charges if they consolidate their spectrum use into lower value bands, creates a positive incentive for departments to play their part in meeting the government's commitment to making more spectrum available from the public sector.

Meeting the 750MHz target

3.17 The table below sets out Ofcom's views of the bands which are currently most valuable to private sector spectrum users, based on its regular demand monitoring and forecasting. Departments have agreed to consider the technical feasibility, desirability and practicality of releasing or sharing each band through a series of CMU-commissioned studies. The CMU will provide updates on these in its annual reports.

3.18 The old target focused on bands below 5GHz and remains relevant: we will continue to pursue opportunities for release or sharing in these bands. However, we believe that limiting the PSSRP to spectrum below 5 GHz is too restrictive, given that technological developments have made higher spectrum frequencies more valuable than they were previously.

3.19 The PSSRP will concentrate on key spectrum bands that are both: a) of real value to civil users, and b) offer a realistic prospect of being released or shared. Our recommendation is for a revised target for the release/sharing of 500 MHz of high value public sector spectrum by 2020, with explicit priority on three identified high value bands – namely, the lower 2.3 GHz and 1427-1452 MHz bands (for mobile) and 380-385 MHz alongside 390-395 MHz (for possible Internet of Things applications).

3.20 We also recommend an additional target for the release/sharing of a further 250 MHz of valuable spectrum by 2022 – making a revised target of 750 MHz under 10GHz of spectrum in total.

Table 3.A: PSSR 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 – 138.3125 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 – 1165 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. Some emergency services may need to remain in band after 2020.
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	2016 – 2018	Up to 55	Possible use for broadband backhaul
Sub-total under 5GHz			**Up to 500MHz (including released)**	

Band	Lead dept.	Target release	Quantity (MHz)	Status
C: Priority bands above 5GHz				
5350 – 5470 MHz 5725 – 5925 MHz	MoD / BIS / DfT	2017 – 2022	Up to 245	Dependent on ITU-R studies towards WRC19. Possible Wi-Fi or fixed link sharing
7.9 – 8.4 GHz	MoD	2016 – 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	2016 – 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***	

**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.*

Objective approach to Cost Benefit Analysis

3.21 Feasibility and technical studies to explore the options for release or sharing of spectrum in all of the priority bands will commence in the coming months, with some workstreams already underway. A number of departments have an interest in these high value bands which are in active use for important public services that will need to be maintained either in their current form, or through other means. In some cases, bands are subject to designated use under international treaties (e.g. NATO), meaning that further engagement and consultation will be required as part of the feasibility and technical work.

3.22 The 'high priority' bands are difficult bands. The CMU believes, however, that for the PSSRP to succeed the potential release of such bands cannot be dismissed as too difficult – this could be said of any band. Feasibility studies will consider the potential for either release or sharing and what obstacles, technical or otherwise need to be addressed to free up spectrum within them.

3.23 The CMU recognises that public sector users are likely to require access to new spectrum to which they could move their service if this is necessary and cost effective. This provides context for the work set out above on public sector sharing in 2.7GHz to 2.9GHz. Ofcom will ensure that departments are able to access spectrum for new applications on the same basis as private sector users.

Assessing long term spectrum needs in the public sector

3.24 We acknowledge that as new capabilities are required and as new applications and technologies develop, public sector spectrum needs may increase as well as change – for

example, advances in unmanned aerial technology may require access to bands already in use, including by the private sector.

3.25 It is important for departments and Ofcom to understand what will be necessary to support the continuation of these important public services both within the UK and overseas. Ofcom and the CMU will therefore seek to develop a framework in which departments are confident of being able to meet their long-term spectrum needs.

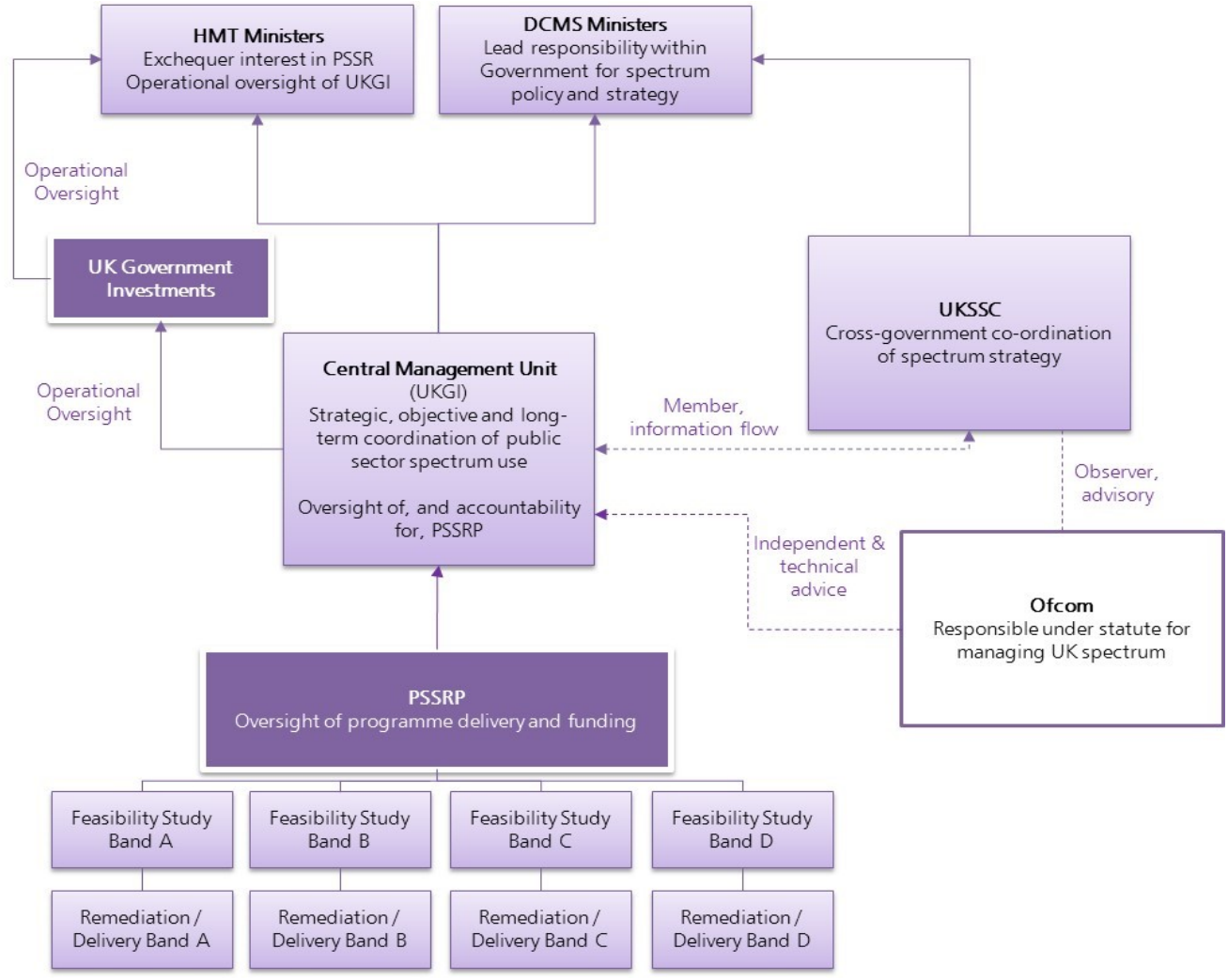
3.26 The CMU will work with the Department for Transport and its Agencies to develop and pilot an approach to assessing future spectrum needs. CMU will report back in its next annual report on progress with a view to extending the pilot to all public sector users by 2018.

4 Programme governance

4.1 Good governance is at the heart of any successful delivery structure, supporting improved accountability and providing challenge and incentives. The CMU has reviewed the governance of the PSSRP to ensure it remains fit for purpose and effective in supporting delivery of the target.

4.2 As part of UK Government Investments, the CMU now reports to the UKGI Board and upwards to HMT on its performance. Policy responsibility for spectrum and the PSSRP continues to sit with DCMS. The UK Spectrum Strategy Committee (UKSSC) will continue to retain responsibility for coordinating policies and plans for the management of radio spectrum. There is no change to Ofcom's remit.

Figure 4.A: Graphic of PSSRP governance



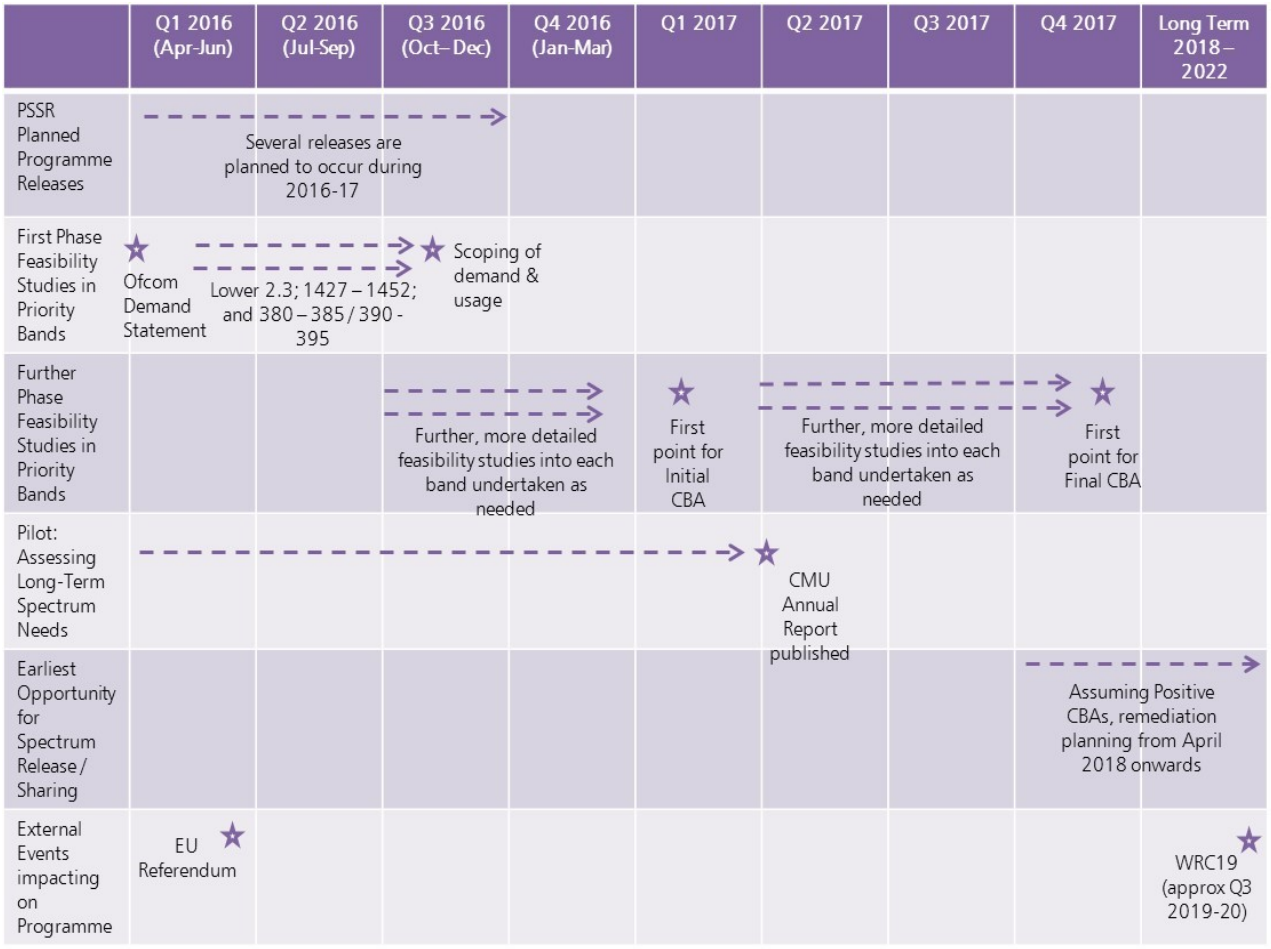
4.3 The CMU's terms of reference[1] set out its broad remit, its independence (from policy and spectrum-user departments as well as Ofcom), its direct access to ministers (now both HMT and DCMS), and a framework for governance for the PSSRP. This document builds on that framework and provides further details as to how decisions will be made at a more practical level:

[1] https://www.gov.uk/government/publications/centralised-management-of-public-sector-spectrum

- *Collective ministerial decision making* will ensure that all decisions regarding public sector spectrum use are taken in the round, giving due weight to operational, financial and policy considerations. Ministers will consider advice from the CMU incorporating statements of demand and public sector spectrum usage, and the underpinning CBAs.
- A *Programme Board* containing representatives of departmental spectrum users, the CMU and Ofcom, will oversee detailed programme delivery and will escalate risks and issues to the programme's Senior Responsible Owner (SRO). The Programme Board will have visibility of, and accountability for, all feasibility studies as well as any remediation workstreams. The Programme Board will also oversee the production of CBAs (which will be led by departmental spectrum users).
- *Technical Groups* will lead work on individual bands of spectrum, overseeing feasibility studies, exploring specific issues as commissioned by the CMU, and in the future, overseeing remediation delivery.

A Illustrative implementation plan

Illustrative implementation plan PSSR Programme 2016 – 2022



In case of queries on this paper, please contact one of the people listed below:

Contacts

Helen Mitchell – Head of CMU

helen.mitchell@ukgi.gov.uk

020 7215 2262

Rob Faull – Programme Delivery Lead, CMU

robert.faull@ukgi.gov.uk

020 7215 6625

Eric Salem – Strategy and Communications Advisor, CMU

eric.salem@ukgi.gov.uk

020 7215 4787

Paul Norris – Senior Responsible Officer

paul.norris@ukgi.gov.uk

020 7215 5626