



Spectrum Review

*A review of the management of the spectrum currently used
for point to point fixed links and other services that share this
spectrum*

Call for Input

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Section 1

Summary

- 1.1 Ofcom has initiated a Review to consider whether we should make changes to spectrum management policy across a number of bands between 1.4 GHz and 86 GHz that are currently available to fixed links. A total bandwidth of 12 GHz spread across fourteen different bands is managed by Ofcom with access available via one of a number of fixed link licence products that are subject to close technical coordination; it is these bands which form the core focus of this review. As a first step we are focusing on the likely drivers of changes in demand for these spectrum bands over the next 5 to 10 years. We expect subsequently to consider possible changes to the way these bands are managed.
- 1.2 We believe this is the right time to review the management of this spectrum in view of recent changes that we have seen in the downstream services that use this spectrum and in view of the potential for significant changes in demand going forward. The review is intended to inform Ofcom decisions on the future management of these bands in the UK as well as to inform our stance in the international regulatory environment in the ITU, CEPT and the EU over the next 5-10 years.
- 1.3 This Call for Input initiates the first public phase of the Review by inviting stakeholders to present information and evidenced views to help us understand the potential evolution of spectrum demand across these bands and to help us determine the scope and scale of the policy issues that might be addressed in due course. In seeking to understand the underlying factors which may influence the scale and nature of demand, we are interested not just in fixed links but also in demand from other services that access these spectrum bands now or might wish to do so in future. Proposals for changes to management of this spectrum will need to be based on an understanding of possible future demand evolution.
- 1.4 We are publishing alongside this Call for Input an independent report (the “Aegis study”) commissioned from Aegis Systems Ltd¹ which considers demand for this spectrum over the next 5 to 10 years. Rather than attempt a demand forecast, the consultants were asked to identify the underlying drivers of demand from different industry sectors and consider how different models of service evolution would impact the overall demand/supply balance. We intend that the Aegis study report will help stimulate debate.
- 1.5 At this stage, we are making no specific proposal for change in the way the bands are managed. However, we will welcome initial views on the policy issues and regulatory changes which could facilitate more efficient use of these bands, including bands which are forecast to remain lightly used (in part or all of the UK) and bands where congestion can be expected to result in inefficient use absent regulatory change.

The range of regulatory change is potentially very diverse. It is possible, for example, that changes could be instigated to encourage new models of competitive band management. Less restrictive licensing of some bands to facilitate innovative use of spectrum might also present advantages. Other options include modifications to fee rates and fee algorithms, disposal through auction of part or all of some bands,

¹ The study was conducted by a consortium of Aegis Systems Ltd, Ovum Consulting and dB Spectrum Services Ltd.

extension (or contraction) of the use of light licensing or licence exemption, and reallocation of part or all of some bands. We will decide on which specific policy issues to address when we have reviewed responses to this Call for Input.

Section 2

Background

Structure of this document

- 2.1 This Call for Input is set out in two main sections. In this Section 2, we set out the context for the review, explain which spectrum bands are included within its scope, and the general approach to information gathering and policy evaluation which we plan to adopt. We also discuss the purpose of the report commissioned from Aegis Systems Ltd on likely drivers of future demand in these bands which we are publishing alongside this Call for Input.
- 2.2 In Section 3, we comment on the likely drivers of change in demand for this spectrum, and the policy issues and spectrum management options which may need to be addressed as a consequence.
- 2.3 Section 3 sets out some specific questions for stakeholders to consider, although we also include a broad invitation to provide any further views and information which stakeholders believe are relevant. We do not anticipate that stakeholders will, necessarily, choose to answer all questions.

Why we are conducting this review now

- 2.4 There are a number of reasons why it is appropriate now to initiate what could be a broad-ranging review of the spectrum bands that are licensed for fixed links.
- 2.5 Firstly, we are starting to see significant changes in the demand for spectrum used to provide fixed links. Demand from the predominant application, backhaul for mobile networks, is undergoing fundamental change as networks and businesses evolve. At the same time, network operators now have access to a number of bands that were auctioned in 2008 (the “10-40 GHz auction”); in consequence, they have alternatives to the Ofcom managed bands for provision of their wireless backhaul infrastructure. In addition, demand from providers of other services which share some of the relevant spectrum bands now, or could do so in future, may also change significantly (e.g. satellite based services and broadband wireless access). We need to understand what impact the changes could have on demand for these spectrum bands over the next 5 to 10 years.
- 2.6 Secondly, and linked to the above point on the changing nature of spectrum demand, Ofcom faces a range of pressures to enable access to some of these bands for competing applications (both terrestrial and satellite based services). We need an appropriate evidence base on which to consider our policy approach to these issues. This is relevant in the international regulatory fora (the EU, CEPT and the ITU), noting that the international regulatory environment has a significant impact of what we do in the UK. It is, of course, directly relevant to service allocations in the UK as reflected in the technical conditions across the range of licence products we make available and as reflected in the UK Frequency Allocation Table.
- 2.7 Thirdly, the Strategic Review of Spectrum Pricing (SRSP) concluded in December 2010 that we should undertake a review of frequency bands used in the UK for fixed links, with the review encompassing all services that share these bands to reflect our intention to price spectrum through consideration of feasible alternative uses, rather

than just addressing specific licence sectors. The SRSP also highlighted that the review should not be restricted just to pricing but rather be a review of our overall approach to managing these frequency bands and licence sectors.

The scope of the review

2.8 Approximately 37 GHz of spectrum is available in the UK for fixed point to point links. As illustrated in table 1, this includes a wide variety of bands ranging from 1.4 GHz to 86 GHz. The figure also shows the manner in which use in each band is authorised, distinguishing between:

- **Ofcom coordinated:** this spectrum is licensed and technically coordinated on a link by link basis, managed by Ofcom. We set the technical assignment criteria in consultation with stakeholders and we use this to coordinate the links to prevent interference. In one band (at 31 GHz), the assignment function has been outsourced and Ofcom sets the assignment criteria but the link assignments are carried out by a third party manager. All of these fixed link bands consist of a pair of sub-bands which are used, respectively, for the 'go' and 'return' transmission paths. There is around 12 GHz of spectrum in this category spread across fourteen separate bands between 1.4 GHz and 60 GHz.
- **Light licensed:** individual link licences are issued by Ofcom, but the licensees themselves have responsibility for assigning and coordinating their links. Ofcom does not generally specify the channel arrangements in these bands and licensees have the freedom to choose the channel size. Links are registered on Ofcom's wireless telegraphy register and are given priority in the band on a 'date of registration' basis, which can be referred to should an interference case arise. There is around 12 GHz of spectrum in this category located between 64 GHz and 86 GHz.
- **License Exempt:** users of licence exempt spectrum must comply with general conditions intended to prevent or minimise interference, but there is no requirement for users to co-ordinate between each other or notify Ofcom of planned use. There is around 7 GHz of license exempt spectrum available in 57 - 64 GHz.
- **Auctioned / Block licensed spectrum:** around 6 GHz of spectrum which is suitable for fixed links use (amongst other things) is held and managed by 3rd parties. The largest part of this was acquired through the "10-40 GHz" auction that took place in 2008; other blocks in the 28 GHz band were acquired through an earlier auction in 2000. In addition, there is a UK wide licence for two large blocks of spectrum in part of the 4 GHz band. The licensees have wide discretion over the management of the spectrum in question.

2.9 The scope of this review covers the first three categories above, although we expect the main focus to be on the Ofcom coordinated bands. Details on the bands included are shown in Annex 5. In summary, these include:

Frequency Bands Under Review	
"1.4 GHz"	1350-1374.5 MHz paired with 1492.5 -1517MHz
"4 GHz"	3600-4200 MHz

Frequency Bands Under Review	
“5.8 GHz”	5725-5850 MHz
“Lower 6 GHz”	5925-6425 MHz
“Upper 6 GHz”	6425-7125 MHz
“7.5 GHz”	7425-7900 MHz
“13 GHz”	12.75-13.25 GHz
“15 GHz”	14.5-14.613 MHz paired with 15.229-15.35 GHz
“18 GHz”	17.7-19.7 GHz
“23 GHz”	22-23.6 GHz
“26 GHz”	24.5-26.5 GHz
“31 GHz”	31.0-31.3 GHz paired with 31.5-31.8 GHz
“38 GHz”	37-39.5 GHz
“52 GHz”	51.4-52.6 GHz
“55 GHz”	55.78-57 GHz
“60 GHz”	57-64 GHz
“65 GHz”	64-66 GHz
“70 GHz”	71-76 GHz
“80 GHz”	81-86 GHz

Table 1: Spectrum under review

- 2.10 The auctioned / block licensed bands are included in figure 1 for information only because they represent a substitute source of spectrum supply to the bands covered by this review. We also note, for completeness, that there is a small number of fixed links which remain in bands which are closed to new fixed link assignments. These bands are listed in Tables A.5.2 and A.5.3 in Annex 5².
- 2.11 Although the spectrum bands covered by this review have been chosen with reference to their availability for use by fixed point to point links, the review is considering the current and likely future use in these bands by all services. To inform

² We also note that the MOD has announced that it is considering offering limited access to, and has invited expressions of interest in, the following bands (some of which are adjacent to the bands covered by this review): 870-872 / 915-917 MHz, 1427-1452 MHz, 2025-2070 MHz, 3500-3580GHz, 4800-4900 MHz, 10.0-10.125 GHz.

the review, Ofcom is considering the demand that may arise for this spectrum over the next 5 to 10 years from:

- i) Existing users in the spectrum under review (which includes a range of fixed satellite services in some bands as well as point to point fixed links);
- ii) Alternative users of the spectrum under review where the potential alternative users may or may not be compatible with existing use.

2.12 In terms of current use, the majority of fixed links in the UK are used to provide backhaul for cellular networks and are licensed to mobile operators, and to BT (and other fixed network operators) which provides backhaul links to at least one MNO (as well as providing links to a wide variety of other types of end user). As a result, just over 90% of all links which are licensed by Ofcom are held by just eight companies.

2.13 The remaining 10% of individual fixed link licences are spread across more than 300 other licensees, the majority of whom hold only a few licences each. These licensees use fixed links for a variety of applications including broadcast distribution, utility networks, public safety communications networks, broadband and CCTV by local authorities

2.14 The other main uses in the spectrum bands under review relate to:

- Broadband Wireless Access applications at 3.6 and 3.9GHz: and
- A range of satellite based services In the 3.6 – 4.2GHz, 5.925 - 7.075 GHz, 12.75 -13.25 GHz and 17.7-19.7 GHz bands.

Ofcom's approach to the Band Review

2.15 Our approach to this Band Review is sequenced as follows:

- First, we need to understand what the key drivers of changes in demand for the spectrum under review are, and how those might play out in future. We hope to complete this analysis during the first half of 2012.
- Second, and in the light of this analysis, we will consider whether there would be benefits in changing aspects of our spectrum policy or spectrum management approach towards these bands. The range of policy and management issues we might seek to address is an open question at this point. We may conclude that there are few issues that merit active attention in the short term or that the ones which do merit attention can be progressed quickly. On the other hand, if there are a number of significant issues requiring substantial effort to address then we would probably need to prioritise them and plan a programme of distinct work streams over time. The scope and timing of each will depend in part on the views of stakeholders, but will also need to take account of the availability of Ofcom resources in light of competing priorities.

2.16 This Call for Input is intended mainly to improve our understanding of likely future demand for these spectrum bands. However, we have also included a few questions (Questions 11-14) which give stakeholders the opportunity to signal the policy and spectrum management issues that you think should be addressed in subsequent policy phases of this review. These latter questions are intended to help us to start to prioritise the work streams which may flow from the analysis of future demand.

2.17 Although we have no preconceived ideas about the changes which should be made to the way these spectrum bands are managed, the major themes for consideration could relate to:

- Allocation issues to do with which services should have access to particular spectrum bands;
- Band management strategy, including the extent to which Ofcom should package spectrum bands for management by third parties as opposed to continuing to manage the detailed assignment coordination process via well defined licence products; and
- Innovations in the licence products offered in the bands which Ofcom continues to manage, such as in pricing and design of licence products.

2.18 We expect to publish an initial consultation setting out options for change later this year. As set out in the Strategic Review of Spectrum Pricing, we have already committed to reviewing licence fees for the spectrum bands included within this review, and this work stream will form part of the forward programme.

The study commissioned from Aegis Systems Ltd

2.19 Ofcom commissioned an independent study from Aegis Systems Ltd to identify the likely drivers of changes in demand and to develop a set of overall demand scenarios to illustrate the range of possible outcomes. This study is being published alongside this Call for Input <http://stakeholders.ofcom.org.uk/consultations/spectrum-review/>

- 2.20 The study does not attempt to define a central forecast of demand for each band. Instead, the consultants were asked to identify a range of scenarios for downstream service evolution or technological development which would have a material impact on demand for this spectrum. The consultants then assessed the likely impact of each on demand for the various spectrum bands, noting how that impact would vary according to the extent to which the development was adopted (if at all). Finally, the consultants aggregated these individual developments into four hypothetical macro views in which the various potential developments were given varying weight. Broad conclusions were then drawn as to the likelihood of congestion in the various bands.
- 2.21 The Aegis study undertook an extensive programme of engagement with stakeholders when preparing its report and we will welcome comments on the assumptions made and conclusions reached. Although this Call for Input is not a consultation on the conclusions reached by the Aegis study, which does not necessarily represent Ofcom's view in all respects, we believe Aegis' report should serve as a useful trigger for discussion.

Section 3

This Call for Input

- 3.1 As noted in Section 2, this Call for Input is seeking stakeholder views of two key types;
- Firstly, what are the key drivers of change in demand for the spectrum bands under review, and
 - Secondly, what changes to the management of the spectrum under review might be merited by the changing landscape?
- 3.2 Stakeholder views will be used to inform our consideration of possible changes to the way this spectrum is managed. Ofcom's own analysis, and the output of the Aegis study, indicates that demand may continue to be concentrated in particular bands at particular locations. Ofcom will need to ensure that its own actions, including decisions on the way these bands are licensed and priced, contribute to the efficient use of this resource in the interests of UK citizens and consumers,
- 3.3 We note, for example, that some bands are heavily used, and forecast to remain so, while other, potentially substitutable, bands are scarcely used. We also note that some bands face potential demand from competing applications which, absent changes to the way assignments are made, may not co-exist. These situations may not represent an optimal use of spectrum.
- 3.4 In this section 3 we start by inviting comments on likely drivers of changes in demand for the bands under review and what this may mean for the overall demand/supply balance in each band. We then discuss in paragraphs 3.28 to 3.43 a number of strategic themes which may start to suggest changes, to the way we manage these bands, which can help make more efficient use of this resource.

Underlying factors which may influence changes in demand

- 3.5 As noted above, it is not possible to determine precisely the future demand for a given tranche of spectrum as much depends on how downstream services and technology evolve. For this reason the consultants were asked to consider what the underlying drivers are and how these might combine in different scenarios.
- 3.6 The Aegis study proposes a number of macro factors that are likely to impact future demand for the spectrum under review, as follows:
- The strength of the economy;
 - Policy and regulation – in particular, interventions in relation to broadband coverage;
 - Extent of fibre availability;
 - Fixed and Mobile broadband service demand;
 - Public sector demand to support CCTV and a possible new police network;

- Utility demand – in particular to support Smart grids and pollution control;
- Satellite service demand;
- Demand from other fixed link applications.

3.7 In addition, the auctioned bands provide an alternative (to the Ofcom managed bands covered in this review) as a means of meeting the demand for fixed links.

Question 1

What are likely to be the key underlying factors influencing changes in demand for this spectrum (in terms of quantity of spectrum or preferred bands) over the next 5 to 10 years? Please provide band specific evidence to support your view.

Sector specific changes in demand

3.8 In the following paragraphs we draw attention to possible changes in demand for the spectrum under review from particular industry/service sectors. We would welcome information which will help us to understand more clearly how demand may change over the next 5 to 10 years. In general we would prefer to publish all responses to inform the public debate. However, we recognise that some information may be confidential and we will respect this, consistent with our legal obligations, if the confidentiality is made clear to us. (See Annex 1 paragraphs A1.7 to A1.9.) In some instances stakeholders may prefer to discuss the issues with us at a confidential bilateral meeting. We also recognise that some stakeholders may not wish to address all of the questions, and we will of course welcome informed comment on any subset of questions.

A possible trend towards consolidation of demand from mobile backhaul

- 3.9 Demand for fixed links spectrum, particularly in bands above 10 GHz, is currently dominated by mobile backhaul. As the Aegis study observes, the large number of assignments made directly to MNOs is likely to have been further amplified by assignments to fixed network infrastructure providers who support mobile network backhaul through outsourcing arrangements.
- 3.10 The Aegis study notes, however, that, despite an increase in mobile data requirements, there has been a significant reduction in the number of fixed links, assigned in the spectrum under review, particularly in bands above 20 GHz, during the 18 month period which preceded the study. Furthermore, the Aegis study proposes that the declining trend is likely to continue due to the following drivers in the mobile market:
- i) Continuing consolidation of backhaul facilities due to network sharing and service level joint ventures;
 - ii) Increased use of existing auctioned spectrum to support mobile backhaul (including auctioned spectrum suitable for fixed links and spectrum currently used primarily for the consumer air interface) – enabling release of Ofcom managed spectrum;
 - iii) Increased use of fibre under some scenarios.

- 3.11 While there has been a decline in the overall numbers of fixed links, this alone does not give a complete picture of the likely future call upon the spectrum under review, since the capacity of the links and the bandwidth of these links is also a major factor. For example, there may be a trend towards a smaller total number of links but with higher capacity/bandwidth requirements.

Question 2

Will the reducing trend in the numbers of fixed links in the spectrum under review to support mobile backhaul continue? If so, in which bands will this reduction be most apparent and how will link capacity/bandwidth requirements change? What factors will have the biggest influence on the outcome? In your view, what will be the impact, on spectrum demand, of deploying next generation mobile networks for example using Long Term Evolution (LTE) standards?

Public safety applications

- 3.12 Some of the frequency bands under review are also used for infrastructure/backhaul provision of public safety networks which are managed by entities in the UK on a regional basis. Ofcom is aware that the Home Office is now in the process of exploring future communications systems that are likely to encompass broadband capabilities. This activity is captured under the banner of the Emergency Services Mobile Communications Programme. Ofcom would be interested in views on the potential influence such future change may have on the demand for the spectrum under review. Ofcom would also like to understand whether other public safety network operators are planning further evolution of their networks such that is likely to impact the demand for the spectrum under review.
- 3.13 The Aegis study proposes that public safety applications could have a strong influence on future demand for fixed links spectrum. The Aegis study cites, in particular, the possibility of a new national public safety broadband network which could require significant spectrum resources (although we note that the illustrative timeframe for such a network in the Aegis study is ambitious). The Aegis study notes that, in the absence of such a network, individual authorities are likely to roll out their own enhanced communications facilities

Question 3

How might the changes to current or future public safety networks influence the existing and future requirement of the spectrum under review for fixed link backhaul for public safety applications over the next 5-10 years? In which spectrum bands is demand most likely to arise and how much spectrum would be required? May demand for bands currently used by public safety applications decrease? Is it likely that the public safety services may require access to the spectrum under review for other data networks or for alternative uses?

Spectrum use by local authorities

- 3.14 Although local authority use of fixed links makes up a small proportion of total use of the spectrum under review, the Aegis study highlights the impact of a hypothetical increase in demand for spectrum if greater use is made of CCTV. The Aegis study draws attention to developments in three individual local authority areas where fixed links are used to provide backhaul and notes that if these applications were replicated nationally, this could have a significant impact on overall demand for fixed links spectrum.

Question 4

How likely it is that use of CCTV by local authorities will significantly increase overall demand for fixed link infrastructure spectrum over the next 5 to 10 years? If so, in which bands is the additional demand most likely to be required and why? Do you have any information about the relative costs of wired and wireless CCTV links in urban and rural areas?

Satellite services

- 3.15 Within international fora, such as CEPT and the ITU, satellite operators have indicated a possible need for additional spectrum, in a variety of bands, to support fixed, mobile and broadcast satellite services, and scientific programmes such as earth exploration, space research and meteorology. These include:
- A proposal for an additional 400 MHz of spectrum between 4 and 16 GHz, said to be required within the next 10 years to support Mobile Satellite Services;
 - A proposal for spectrum in some bands subject to this review to support satellite based applications which may in future be capable of being carried by Unmanned Aircraft Systems;
 - Spectrum in the band 7850-7900 MHz for additional allocation for meteorology satellites and in the band 22.55- 23.15 GHz for Space Research Service to support future requirements for science applications.
 - Spectrum in the 24 GHz band to be used for feeder links to support broadcast satellite applications such as High Definition TV;
 - Additional spectrum in the 18 GHz band to accommodate demand from Fixed Satellite Services, including satellite broadband services, which may no longer be able to access sufficient spectrum in the lower Fixed Satellite Service bands;
 - A potential demand for new allocations at 7 GHz for Fixed Satellite Services to support government applications.
 - Possible future growth in demand for access to Q/V band (37-52 GHz), where demand from Fixed Satellite Services is currently almost non-existent.
- 3.16 We note that satellite services, by their nature, tend to be international in scope and, therefore, require a high degree of international co-ordination. We also note that it is difficult for some satellite based services, in particular consumer broadband services that could be ubiquitously deployed to share frequency bands with other applications unless the band has been segmented or appropriate interference mitigation measures, if feasible, have been applied to support such sharing. These factors, and the long lead times for equipping and launching new satellites, and the impracticality of retrofitting new radio equipment after launch, often necessitate long term spectrum planning.

Question 5

(a) What are the main factors (technical or regulatory) that determine preferences for one band over another for satellite applications? Do these factors vary between different types of satellite applications (Mobile, Fixed, Broadcasting and Science services)? In which bands will we see the most significant changes in demand in the next 5 to 10 years, and why?

(b) A number of the frequency bands under review are currently used for satellite Permanent Earth Stations (PESs), for example to feed Direct to Home satellite broadcast services. What are the continued and future spectrum requirements for satellite PESs (E-s & s-E) likely to be and in which bands? Please provide evidence to support your views.

(c) During recent years, some commentators have forecast significant demand for spectrum to support satellite consumer terminals. To date this demand has been slow to materialise. Do you have information which would help inform a more accurate assessment of future demand for spectrum in bands currently shared with fixed links?

(d) Are there factors specific to the satellite based communications sector which mean that it faces particular difficulties evidencing and satisfying demand for spectrum? If so, how might these be overcome?

Power and water utilities

3.17 In December 2009 the Department for Energy and Climate Change published its *Smarter Grids The Opportunity*³ in which it noted that “smarter grids” will be integral to the transition to a lower carbon economy. In its report for Ofcom, the Aegis study proposes that smart grids are likely to have a significant impact on demand for spectrum.

3.18 The Aegis study notes that current use of spectrum to support scanning telemetry base stations in the water and power industries can be expected to remain fairly stable, although capacity may need to be expanded. However the Aegis study proposes that roll out of Smart systems could have significant impact on demand for fixed links spectrum.

Question 6

What is the likely timetable for rollout of Smart Grids and what impact will these developments have on demand for spectrum in the bands covered by this review?

Broadcasting

3.19 A recent Ofcom consultation⁴ on DAB coverage planning noted that the expansion of DAB networks is likely to place additional demand in the 7.5 GHz and 13 GHz bands. Fixed links are used to distribute multiplexed signals to many broadcasting sites. Our consultation predicted that a doubling of the number of existing sites would be required to deliver enhanced local coverage and launch new local networks. We also commented that national DAB networks, too, would require a significant number of additional transmitters and many of these would receive their feed by satellite distribution.

³http://www.decc.gov.uk/assets/decc/What%20we%20do/UK%20energy%20supply/futureelectricitynetworks/1_20091203163757_e_@@_smartergridsoportunity.pdf

⁴ <http://stakeholders.ofcom.org.uk/consultations/dab-coverage-planning/>

- 3.20 Ofcom continues to license new community radio services and this may lead to a small increase in the need for fixed link spectrum. The number of other, larger scale, analogue radio services (both commercial and BBC) is expected to remain relatively static and continue to require present levels of spectrum. However, the proposed migration of many analogue radio services to DAB would inevitably lead to a reduction in the requirement for fixed link spectrum.
- 3.21 Switchover of analogue television services to digital will be completed by the end of 2012. There will be some changes to the transmission infrastructure in 2013 in order to clear digital terrestrial television from channels 61 and 62 in UHF Band V, although this is not expected to result in a significant change in requirements for fixed links. Ofcom is developing plans to auction UHF spectrum from the Digital Dividend in the 600 MHz band. Use of this spectrum for DTT or other potential uses is not expected to significantly increase the requirements for the spectrum under review. Therefore, the overall requirement for spectrum for fixed links needed for television transmission is expected to remain relatively stable for the immediate foreseeable future.

Question 7

What impact will DAB expansion have on demand for the spectrum under review? Are there any other demand drivers that Ofcom should consider in relation to broadcasting use or services related to broadcasting?

Broadband Wireless Access

- 3.22 There are some frequency bands subject to this review that could be used for broadband wireless access (both fixed and mobile including nomadic). Ofcom would like to understand the future demand that may arise from broadband wireless access applications for the spectrum under review and whether additional backhaul spectrum needs to be considered to support such access applications
- 3.23 As the Aegis study noted, users of fixed broadband services typically consume far more capacity than users of mobile broadband services. As such, demand for radio based backhaul in remote rural areas is likely to be influenced by the extent to which fixed rather than mobile wireless broadband services are rolled out in rural areas not served by cable or copper based broadband.

Question 8

a) What is the likely demand for broadband wireless access applications in the spectrum under review and which bands is this likely to specifically impact? How should Ofcom consider the demand for backhaul to support such applications and is such backhaul demand likely to arise in the spectrum under review?

b) Do you consider that the emergence of rural broadband fixed wireless access will influence overall demand for the spectrum under review and to what extent? Which bands is this likely to impact most?

Programme making and special events

- 3.24 Programme making and special events have access to spectrum, within and adjacent to some the bands under review, for wireless cameras and video links.

- 3.25 PMSE users' preferred band for wireless cameras and video links to date has been the 2 – 3 GHz band (approximately 7000 assignments in 2010 in various sub-bands from 2025 – 3580 MHz). However, these services will face a reduction in the amount of spectrum they can use when we auction the 2.6 GHz band and with the release by the MOD of spectrum in the 3.4-3.6 GHz band. It is anticipated that this may cause an increase in demand for the 5 and 7 GHz bands.

Question 9

Do you consider that there will be a material additional demand from the PMSE community for access to the spectrum under review? Which bands under review is this likely to impact most and to what extent?

Use of fibre as a substitute for spectrum

- 3.26 The cost and availability of fibre may have a strong bearing on demand for the spectrum under review. In Aegis' view, over the next 10 years, this impact will be felt most strongly in urban and suburban areas, and mainly in bands above 20 GHz. The Aegis study observes that any further regulatory action to mandate access to fibre and/or primary infrastructure may further reduce demand for wireless backhaul links in the spectrum under review. Ofcom is currently reviewing the market for leased lines, including backhaul links, in the Business Connectivity Market Review (BCMR).⁵ Under current rules, BT is required to provide certain types of leased lines (including to mobile networks' sites) at charge-controlled prices. Stakeholders will have an opportunity to comment on any matters within the scope of the BCMR as part of a forthcoming consultation. For the purposes of this fixed links spectrum review, we note that it will be specifically important for Ofcom to better understand the impact of the economics of fibre versus wireless backhaul on demand for the latter.

Question 10

How might the economics of new fibre provision (with or without reliance on regulatory remedies – whether active or passive), as compared with wireless provision of both terrestrial and satellite based services, impact on the requirements for wireless backhaul? We are interested in the possible impact, in terms of the extent of possible substitution for wireless links and in terms of the nature of wireless links affected (urban v. rural, lower / higher frequency bands).

Spectrum management policy issues for consideration

- 3.27 Having considered possible drivers of demand in specific industry sectors, we now consider some of the spectrum management issues which we may face in the light of changing demand for the spectrum bands under review.
- 3.28 As noted in paragraph 2.17 above, these issues may fall into three broad categories; decisions to do with allocation of spectrum bands to particular service types, decisions to do band management strategy and the extent to Ofcom continues to undertake detailed assignment management as opposed to packaging spectrum

⁵ We published a Call for Inputs in relation to the BCMR on 21 April 2011 at http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-inputs/summary/BCMR_Call_for_Inputs.pdf

bands to be managed by third parties and, depending partly on views on the first two sets of questions, possible changes and innovations in the set of the licence products available to spectrum users. Responses to this Call for Input will help us frame the scope of the review, but we are likely to consider a wide range of options, potentially including, but not necessarily limited to, the following;

- Band segmentation and/or changes to band allocations including, for example, potential access to C Band (3-4GHz) for broadband wireless services and the potential extension of access in Ka Band (18 / 28 GHz) for satellite based services;
- Auctioning of some bands or part bands;
- Wider application of light licensing (where technical and geographic details are published and licensees are obliged to co-ordinate use with others);
- More licence exemption (where frequencies may be used by anyone provided that specified conditions are adhered to);
- Greater use of third party band managers, which could take a number of forms including (i) operating in a competitive market using auctioned spectrum combined with an extension of leasing (ii) using auctioned spectrum for self provisioning of wireless backhaul infrastructure in a large network (iii) acting as an agent for Ofcom and subject to conditions requiring supply on fair and reasonable terms;
- Changes to the technical specification of some Ofcom licence products and to some of their licence fees; and
- More flexible licensing arrangements to facilitate innovative uses of spectrum.

3.29 We elaborate on a few of these areas below.

Access to the Spectrum by other services

3.30 The point to point fixed link licence products in the Ofcom managed bands have tightly defined technical characteristics, designed to meet the very high levels of availability that are required of wireless backhaul infrastructure (typically 99.99% or “four nines”). The deployment of each new link has to be coordinated with existing links and with any other services using the same band. As a result, fixed links can share spectrum with other types of use, but only where these can be subject to an equivalent degree of close technical coordination. This is the case for fixed satellite earth stations with the result that fixed links and fixed satellite services (“Permanent Earth Stations” or PESs) share spectrum access in a number of bands. However, fixed links can not share easily with mobile or nomadic services (whether terrestrial or satellite based). Neither do they share easily with fixed services which have a “high density” deployment of consumer terminals (e.g. satellite dishes) since it is largely impractical to have effective technical coordination where there is are very large numbers of consumer terminals (and if these are licence exempt then we do not have the information on location that would be required for technical coordination in the first place).

3.31 As a result, where new services are looking to access bands currently used by fixed links, the question of spectrum access often translates into a choice between continued use of fixed links *or* closing the band to fixed links to enable access for the

new use. In general, we have a preference for decisions on access competition of this type to be driven by the market, although we need to recognise that this is not always possible. In this context, a number of points are worth noting:

- There can be a strong read-across from the international regulatory environment to what makes sense to do in the UK in these bands. Where the competition for band access comes from satellite based services these operate under international spectrum allocations. And where the competition for band access comes from terrestrial based services the choice frequency bands are often driven by international standards (e.g. for IMT). In consequence, the decisions on spectrum access for different services in these bands are often tied in with what we do in the international regulatory environment;
- There is also a strong link to the band management issue discussed below: if blocks of spectrum are packaged up and transferred to third party band managers then decisions over which services can access a band can be driven by commercial incentives (though the band manager will still be constrained by the technical conditions we have to impose on its spectrum block which, in turn, will have to take account of the international regulatory environment and the need to manage interference with other users adjacent to their spectrum block);
- Where Ofcom is faced with a choice over spectrum access by different services (i.e. choosing which licence products to make available in a spectrum band where different uses are incompatible), then we need to be informed by prospective demand, and by the prospective value attaching to this demand, from the competing services. The results of the Aegis study on the demands pressures in different bands are relevant in this context; the study has proposed that there will be sufficient spectrum to meet all anticipated future needs for fixed links which use spectrum in bands above 20 GHz: meanwhile, the Ofcom managed 52 and 55 GHz bands remain unused.
- Where the use of fixed links in a given band is fairly sparse, or where their use is concentrated in one type of situation (e.g. remote rural only or urban areas only) then it might be possible to consider a geographical segmentation of the band – for example, in order to support innovation, making spectrum available for trialling new type of use in areas away from where the fixed link population is located.

3.32 One specific example where Ofcom might consider opening access to new services relates to the 3.6 – 4.2 GHz band (C Band). This band is used extensively by satellite earth stations across the full range. Fixed point to point links are licensed in 3689-3875 MHz and 4009-4195 MHz. Both types of use are authorised via standard Ofcom licence products. Broadband Wireless services are licensed in two, UK wide blocks at 3605-3689 MHz and 3925-4009 MHz. We would be interested in views as to whether these access arrangements should be adjusted, for example through increasing access for broadband wireless type applications in this range.

3.33 Other examples of access competition lie in the rivalry between providers of fixed and satellite based services, with each group lobbying within the UK and internationally for exclusive access to certain bands or sub bands. Inevitably, arguments often rest on claims of future demand for particular types of services. It is often difficult for the regulator to judge between contending claims because of lack of information and uncertainty about the future.

3.34 A current case in point relates to future access to the 18 GHz band. As the Aegis study has noted in its report, in some scenarios the 18 GHz band may be required by

fixed network operators to accommodate overspill demand which the substitutable 13 GHz and 15 GHz may be unable to meet. On the other hand, operators of satellite earth stations claim that large parts the international shared band (17.7-19.7 GHz) may be needed at a national / regional level on an enhanced regulatory basis to support high density fixed satellite service receiver terminals for corporate and consumer broadband.

- 3.35 Ofcom will continue to consult stakeholders and take independent advice on the likely future demand for bands in contention between two potentially incompatible services; in part, this Call for Input is one such exercise. Such research also informs our stance at international forums where international allocations are decided.

Question 11

What issues relating to spectrum access for different services do you think Ofcom should review? How might Ofcom start to rely more on commercial decisions when determining allocations of spectrum in the bands covered by this review?

Band management approach

- 3.36 The approaches to licensed spectrum management can be one of two broad types:
- Ofcom itself manages the spectrum band and makes available a range of licence products which authorise transmissions of a certain type at particular locations and which are coordinated (or “technically assigned”) under well defined technical frequency assignment criteria (TFAC); these licences are usually available on a first come first served basis and have a licence fee specified in regulations⁶.
 - Ofcom packages the spectrum into blocks with large bandwidth (and, typically, on a regional or UK-wide basis) that are licensed to a single commercial entity (e.g. via an auction process) to maximise the benefits that the licensee can derive from the resource – this is the management arrangement which applies to auctioned spectrum.
- 3.37 Looking at the current balance between these two approaches in respect of spectrum that can be used for fixed links, there is (as set out in section 2) some 12GHz of spectrum across fourteen separate bands which is coordinated under Ofcom management at present as compared with 6GHz across five main bands that is managed by commercial players following auctions or block assignment. One question for this review could be whether we should consider transferring more spectrum from the Ofcom managed approach to the commercial band management approach.
- 3.38 The band management model can come in a variety of forms. For example, the licence holder for the block of spectrum might be interested in using the spectrum for its own purposes (e.g. self provisioning of wireless backhaul in a nationwide network). This approach might be relevant in the current context, given that more

⁶ Where Ofcom manages the licence products in a band there is a number of ways that this can be delivered. In most bands, Ofcom carries out all the licensing-related activities in-house. In other cases, a third party can carry out aspects of the technical assignment and licensing activity on our behalf. For example, a third party carries out the technical assignment work in the 31GHz band covered by this review (Ofcom retains responsibility for the licence products and the Ofcom Licensing Centre issues the licences themselves once the technical assignment work is complete). In the PMSE bands, the assignment and licence issuance is carried out by JFMG under contract to Ofcom (but with Ofcom retaining the ownership of licence product definition and fees etc).

than 80% of the existing links licensed by Ofcom are used by just a handful of companies to support nationwide networks.

- 3.39 Alternatively, a commercial band manager might look to provide services to third parties (Transfinite's management of its 28 GHz block is an example of this approach). There is a wide variety of business models which could be used to define the relationship between providers and users of radio based communications services. These range from the provision of an end to end managed service (including terminal equipment) to the leasing of a frequency assignment alone. Recent changes in relation to the spectrum leasing⁷ have provided greater flexibility in this regard⁸. Band managers have commercial freedom over the way that they use this spectrum and the prices payable by end users reflect the market value which the communications service can command⁹.
- 3.40 We note that the introduction of new band management might require changes to existing assignments. For example, in some circumstances it might be necessary for existing users to move to another band. In other cases, existing users might retain their existing rights, subject to commercial discussion with the incoming band manager, and an overlay auction might be used to define the rights and responsibilities of the new band manager.

Question 12

We would welcome views on the potential for more widespread use of market based approaches to the spectrum under review such as third party band management, and the regulatory steps which would need to be taken to facilitate this.

Licence products

- 3.41 We would be interested to hear stakeholder views on the form of licence products that Ofcom makes available in the bands that we manage on a coordinated basis. As noted above, the products for point to point fixed links are highly defined in order to meet very high availability criteria. We would be interested in views as to whether the products remain fit for purpose or whether they might need to be adapted in light of changing technology and usage patterns connected with, for example, asynchronous data-flow, adaptive power control, bandwidth etc. We note that, while there is a wide range of point to point licence products, we currently offer no point to multipoint licences.
- 3.42 Some bands are currently used only lightly. As noted above, the Aegis study suggests that there will be sufficient spectrum to meet all anticipated future needs in bands above 20 GHz and we note that the Ofcom managed 52 and 55 GHz bands remain unused. This suggests that, overall; there is ample scope for some bands to be worked more intensively in the interests of UK citizens and consumers. In principle, more flexible conditions of use and/or changes to fees structures, for some or all bands, in some or all areas, might enable innovative new applications.

⁷ See statement *Simplifying Spectrum Trading - Spectrum leasing and other market enhancements* published by Ofcom on 29 June 2011 at

<http://stakeholders.ofcom.org.uk/consultations/simplify/statement-spectrum-leasing/>

⁸ All of the bands covered by this review are tradable with the exception of the 31 GHz band.

⁹ The only reason to depart from this approach would be if there were material concerns about over a particular group of spectrum users being dependent on specific band managers without the protection of effective competition between them. Under these circumstances, there could be a case to impose "fair, reasonable and non discriminatory" conditions.

- 3.43 Bands above 50 GHz are either licence exempt (60 GHz) or light licensed (65/70/80 GHz). We note however the observation by the Aegis study that some stakeholders have argued that light licensing arrangements may, in some instances, fail to provide sufficient protection to users and that a different form of licensing may be preferred, for example in the 70 GHz and 80 GHz bands.

Question 13

(a) Do you consider that any changes should be made to the Ofcom licence fixed link product set?

(b) Might a more flexible approach to licensing, in bands where demand is unlikely to exceed supply for the foreseeable future, enable more intensive use of these bands? If so, what form might the licensing take and in which bands would this be appropriate?

(c) Are there other actions which Ofcom could take to improve spectrum efficiency by encouraging migration to or use of higher, less heavily used, bands, with a view to freeing up spectrum in popular lower frequency bands?

Fee review

- 3.44 As discussed in the Strategic Review of Spectrum Pricing, we plan to review the fees which apply to Ofcom licence products in the bands covered by this review. These products cover point to point fixed links and the satellite earth station products which also access some of these bands. In accordance with the principles set out in the Strategic Review of Spectrum Pricing, we expect this review to take account of, amongst other things: the pressure on these bands as signalled by the level of prospective licence product demand as compared with available bandwidth across different bands; the opportunity cost associated with other prospective uses of the bands; evidence of market valuation including auction prices. The review of licence product prices will also need to take account of the extent to which fees cover the administrative cost of the licensing process.
- 3.45 The review will consider not only the absolute level of fees but also, potentially, the structure of fees for some licence types. Current algorithms for determining fees for some licence types are highly complex and include a number of weighting factors intended to encourage efficient use of these bands. Previous reviews have observed that some of these factors may generate less than optimal outcomes, but these reviews have concluded, after extensive consultation with stakeholders, that new weighting factors would be complex to define and resource intensive to administer. The current review will, similarly, need to take into account the resource implications of any changes, but improvements to some fee algorithms to reflect geographic variations in demand may be a priority.
- 3.46 Demand for these spectrum bands can vary significantly, for example high concentrations of fixed links can occur, defined by topology and population centres, and at nodes where data is aggregated. This geographic variation in demand is not currently reflected in fees. The absence of a geographic fee modifier may make the use of these bands outside major conurbations uncompetitive, which could further inefficiently increase the amount of unused spectrum. For example, it is conceivable that, in these areas, providers of managed communications services might instead use auctioned spectrum or alternative technology (such as fibre) if services reliant on spectrum acquired on a circuit by circuit basis from Ofcom cannot compete in the managed services market.

- 3.47 As early as 2003, the Radiocommunications Agency (“the RA”), which was responsible for spectrum management before its transfer to Ofcom, proposed that fees should be based on precise nodes or sites to recognise the site or route-specific nature of demand for fixed links. Historically in certain ‘trunk’ bands it was not unusual for most links to point in the same azimuth directions along the main trunk routes, with few or no links pointing in other directions. Hence, while a site might be highly congested in certain azimuth directions, assignments in other directions might be easily accommodated. The RA proposed that if more than a certain percentage of the available spectrum had been assigned, a geographical ‘congestion modifier’ would then increase the fee in congested sites at either or both ends of the link. However, establishing consensus on the appropriate percentage proved difficult. Ofcom subsequently flagged in the 2004 pricing review¹⁰ that a discount factor on the use of a channel in certain remote rural locations might be appropriate. Here again, a practicable formula proved elusive.

Question 14

What is your view on the impact of geographically uniform fees for spectrum bands included in this review? If you consider that a geographic fee modifier would promote more efficient use of spectrum, how might that modifier be constructed?

Other issues

- 3.48 We would welcome other information which you consider is relevant to our review of possible changes in demand for fixed links spectrum and our assessment of possible changes to the management of the spectrum under review to enable more efficient use of these spectrum bands.

Question 15

Are there other aspects of the review on which you have evidence that would help inform our consideration of these issues and formulate proposals for consultation?

Question 16

Is the proposed list of bands to be included within the review (as set out in Figure A.5.1 in Annex 5 appropriate?

Next steps and timescales

- 3.49 Stakeholders have until 30 April 2012 to respond to this Call for Input. During that time we may also engage informally with some stakeholders through bilateral meetings. Any stakeholders that wish to have such a meeting with the Ofcom project team should get in touch as soon as possible.
- 3.50 We will review the information and views provided by stakeholders and consider what changes, if any, might be made to facilitate more efficient use of this resource. We expect to publish a further public document during the summer of 2012. Whether this includes formal proposals for changes to the management of these bands (including pricing) will depend in part on the nature of the information provided in response to the Call for Input.

¹⁰ See statement *Spectrum Pricing* published by Ofcom on 25 February 2005 at http://stakeholders.ofcom.org.uk/consultations/spec_pricing/

Annex 1

Responding to this Call for Input

How to respond

- A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made **by 5pm on 30 April 2012**.
- A1.2 Ofcom strongly prefers to receive responses using the online web form at <https://stakeholders.ofcom.org.uk/consultations/spectrum-review/howtorespond/form>, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.
- A1.3 For larger responses - particularly those with supporting charts, tables or other data - please email mrinal.patel@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.
- A1.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

Mrinal Patel
Spectrum Policy Group
Riverside House
2A Southwark Bridge Road
London SE1 9HA

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

- A1.5 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 4. It would also help if you can explain why you hold your views and how Ofcom's proposals would impact on you.

Further information

- A1.6 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Mrinal Patel on 020 7981 3127.

Confidentiality

- A1.7 We believe it is important for everyone interested in an issue to see the views expressed by respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt. If you think your response should be kept confidential, can you please specify what part or whether all of your response should be kept confidential, and specify why. Please also place such parts in a separate annex.

- A1.8 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and will try to respect this. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.
- A1.9 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's approach on intellectual property rights is explained further on its website at <http://www.ofcom.org.uk/about/accoun/disclaimer/>

Next steps

- A1.10 Following the end of the period allowed for responding, we will assess responses and, where appropriate, publish proposals for changing the way these spectrum bands are managed.
- A1.11 Please note that you can register to receive free mail Updates alerting you to the publications of relevant Ofcom documents. For more details please see: http://www.ofcom.org.uk/static/subscribe/select_list.htm

Ofcom's consultation processes

- A1.12 Ofcom seeks to ensure that responding to a Call for Input is easy as possible. For more information please see our consultation principles in Annex 2.
- A1.13 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk. We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.
- A1.14 If you would like to discuss these issues or Ofcom's consultation processes more generally you can alternatively contact Vicki Nash, Director Scotland, who is Ofcom's consultation champion:

Graham Howell

Secretary to the Corporation

Ofcom
Riverside House
2A Southwark Bridge Road
London SE1 9HA

Tel: 020 7981 3601

Email graham.howell@ofcom.org.uk

Annex 2

Ofcom's consultation principles

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

Before the consultation

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

During the consultation

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

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

A2.5 We will consult for up to 10 weeks depending on the potential impact of our proposals.

A2.6 A person within Ofcom will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. Ofcom's 'Consultation Champion' will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why.

After the consultation

A2.8 We think it is important for everyone interested in an issue to see the views of others during a consultation. We would usually publish all the responses we have received on our website. In our statement, we will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

Annex 3

Consultation response cover sheet

- A3.1 In the interests of transparency and good regulatory practice, we will publish all responses to this Call for Input in full on our website, www.ofcom.org.uk.
- A3.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality where appropriate.
- A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.
- A3.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at www.ofcom.org.uk/consult/.
- A3.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only, so that we don't have to edit your response.

Cover sheet for response to an Ofcom Call for Input

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing Name/contact details/job title

Whole response Organisation

Part of the response If there is no separate annex, which parts?

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

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

Name

Signed (if hard copy)

Annex 4

Summary of questions included in this Call for Input

Question 1

What are likely to be the key underlying factors influencing changes in demand for this spectrum (in terms of quantity of spectrum or preferred bands) over the next 5 to 10 years? Please provide band specific evidence to support your view.

Question 2

Will the reducing trend in the numbers of fixed links in the spectrum under review to support mobile backhaul continue? If so, in which bands will this reduction be most apparent and how will link capacity/bandwidth requirements change? What factors will have the biggest influence on the outcome? In your view, what will be the impact, on spectrum demand, of deploying next generation mobile networks for example using Long Term Evolution (LTE) standards?

Question 3

How might the changes to current or future public safety networks influence the existing and future requirement of the spectrum under review for fixed link backhaul for public safety applications over the next 5-10 years? In which spectrum bands is demand most likely to arise and how much spectrum would be required? May demand for bands currently used by public safety applications decrease? Is it likely that the public safety services may require access to the spectrum under review for other data networks or for alternative uses?

Question 4

How likely is it that use of CCTV by local authorities will significantly increase overall demand for fixed link infrastructure spectrum over the next 5 to 10 years? If so, in which bands is the additional demand most likely to be required and why? Do you have any information about the relative costs of wired and wireless CCTV links in urban and rural areas?

Question 5

(a) What are the main factors (technical or regulatory) that determine preferences for one band over another for satellite applications? Do these factors vary between different types of satellite applications (Mobile, Fixed, Broadcasting and Science services)? In which bands will we see the most significant changes in demand in the next 5 to 10 years, and why?

(b) A number of the frequency bands under review are currently used for satellite Permanent Earth Stations (PESs), for example to feed Direct to Home satellite broadcast services. What are the continued and future spectrum requirements for satellite PESs (E-s & s-E) likely to be and in which bands? Please provide evidence to support your views.

(c) During recent years, some commentators have forecast significant demand for spectrum to support satellite consumer terminals. To date this demand has been slow to materialise. Do you have information which would help inform a more

accurate assessment of future demand for spectrum in bands currently shared with fixed links?

(d) Are there factors specific to the satellite based communications sector which mean that it faces particular difficulties evidencing and satisfying demand for spectrum? If so, how might these be overcome?

Question 6

What is the likely timetable for rollout of Smart Grids and what impact will these developments have on demand for spectrum in the bands covered by this review?

Question 7

What impact will DAB expansion have on demand for the spectrum under review? Are there any other demand drivers that Ofcom should consider in relation to broadcasting use or services related to broadcasting?

Question 8

a) What is the likely demand for broadband wireless access applications in the spectrum under review and which bands is this likely to specifically impact? How should Ofcom consider the demand for backhaul to support such applications and is such backhaul demand likely to arise in the spectrum under review?

b) Do you consider that the emergence of rural broadband fixed wireless access will influence overall demand for the spectrum under review and to what extent? Which bands is this likely to impact most?

Question 9

Do you consider that there will be a material additional demand from the PMSE community for access to the spectrum under review? Which bands under review is this likely to impact most and to what extent?

Question 10

How might the economics of new fibre provision (with or without reliance on regulatory remedies – whether active or passive), as compared with wireless provision of both terrestrial and satellite based services, impact on the requirements for wireless backhaul? We are interested in the possible impact, in terms of the extent of possible substitution for wireless links and in terms of the nature of wireless links affected (urban v. rural, lower / higher frequency bands).

Question 11

What issues relating to spectrum access for different services do you think Ofcom should review? How might Ofcom start to rely more on commercial decisions when determining allocations of spectrum in the bands covered by this review?

Question 12

We would welcome views on the potential for more widespread use of market based approaches to the spectrum under review such as third party band management, and the regulatory steps which would need to be taken to facilitate this.

Question 13

(a) Do you consider that any changes should be made to the Ofcom licence fixed link product set?

(b) Might a more flexible approach to licensing, in bands where demand is unlikely to exceed supply for the foreseeable future, enable more intensive use of these bands? If so, what form might the licensing take and in which bands would this be appropriate?

(c) Are there other actions which Ofcom could take to improve spectrum efficiency by encouraging migration to or use of higher, less heavily used, bands, with a view to freeing up spectrum in popular lower frequency bands?

Question 14

What is your view on the impact of geographically uniform fees for spectrum bands included in this review? If you consider that a geographic fee modifier would promote more efficient use of spectrum, how might that modifier be constructed?

Question 15

Are there other aspects of the review on which you have evidence that would help inform our consideration of these issues and formulate proposals for consultation?

Question 16

Is the proposed list of bands to be included within the review (as set out in Figure A.5.1 in Annex 5 appropriate?

Annex 5

Tables of bands proposed to be included within the scope of the review

A5.1 The following table A5.1 lists the Ofcom managed bands which we propose to include within the scope of the review;

Frequency Band ¹¹		Amount of spectrum available to the Fixed Service ¹²	Method of assignment for the Fixed Service
“1.4 GHz”	1350-1374.5 MHz paired with 1492.5 - 1517MHz	2 x 24.5 MHz	Technically coordinated and assigned on a first come first served basis
“4 GHz”	3600-3875 MHz paired with 3925-4200 MHz	2 x 275 MHz	Technically coordinated and assigned on a first come first served basis 3605-3689 MHz and 3925-4009 MHz is block assigned on a technology neutral basis
“5.8 GHz”	5725-5850 MHz	125 MHz	Light licensed
“Lower 6 GHz”	5925-6167.8 MHz paired with 6182.42-6425 MHz	2 x 242 MHz	Technically coordinated and assigned on a first come first served basis
“Upper 6 GHz”	6425-6760 MHz paired with 6780-7125 MHz	2 x 335 MHz	Technically coordinated and assigned on a first come first served basis

¹¹ UK service allocations for the frequency bands listed are in the UK Frequency Allocation Table <http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/ukfat2010.pdf>

¹² The amount of spectrum given here is indicative as in some bands the size of the paired sub-bands are not equal and also includes guard bands at the band edges.

Frequency Band ¹¹		Amount of spectrum available to the Fixed Service ¹²	Method of assignment for the Fixed Service
“7.5 GHz”	7425-7652 MHz paired with 7673-7900 MHz	2 x 227 MHz	Technically coordinated and assigned on a first come first served basis
“13 GHz”	12.75-12.975 GHz paired with 13.017-13.25 GHz	2 x 224 GHz	Technically coordinated and assigned on a first come first served basis
“15 GHz”	14.5-14.613 GHz paired with 15.229-15.35 GHz	2 x 112 MHz	Technically coordinated and assigned on a first come first served basis
“18 GHz”	17.7-19.7 GHz (variable centre gap) ¹³	2000 MHz	Technically coordinated and assigned on a first come first served basis
“23 GHz”	22-22.6 GHz paired with 23-23.6 GHz	2 x 600 MHz	Technically coordinated and assigned on a first come first served basis
“26 GHz”	24.5-25.445 GHz paired with 25.557-26.5 GHz	2 x 943 MHz	Technically coordinated and assigned on a first come first served basis
“31 GHz”	31.0-31.3 GHz paired with 31.5-31.8 GHz	2x300 MHz	Technically coordinated and assigned on a first come first served basis
“38 GHz”	37-38.178 GHz paired with 38.438-39.5 GHz	2 x 1178 MHz	Technically coordinated and assigned on a first come first served

¹³ See OfW 48 <http://licensing.ofcom.org.uk/binaries/spectrum/fixed-terrestrial-links/guidance-for-licensees/OfW48.pdf>

Frequency Band ¹¹		Amount of spectrum available to the Fixed Service ¹²	Method of assignment for the Fixed Service
			basis
“52 GHz”	51.4-51.944 GHz paired with 52.056-52.6 GHz	2 x 540 MHz	Technically coordinated and assigned on a first come first served basis
“55 GHz”	55.78- 56.346 GHz paired with 56.458 – 57 GHz	2 x 542 MHz	Technically coordinated and assigned on a first come first served basis
“60 GHz”	57-64 GHz	7000 MHz	Licence-exempt
“65 GHz”	64-66 GHz	2000 MHz	Light-licensed on a self coOrdinated basis
“70 GHz”	71-76 GHz	5000 MHz	Light-licensed on a self coOrdinated basis
“80 GHz”	81-86 GHz	5000 MHz	Light-licensed on a self coOrdinated basis

Table A.5.1 Summary of Ofcom managed bands proposed to be within the scope of the review

3.2 The auctioned and closed bands, which are not included within the scope of the review, are summarised in the following tables A5.2 and A.5.3; closed bands are bands that have been closed to use by the fixed service for use by other services. Closed bands still contain legacy fixed links.

Band	Amount of spectrum	Service / application	Licensee(s)
10 GHz	2 x 100 MHz	Service/Technology neutral	MBNL Digiweb
28 GHz	2 x 560 MHz	Service/Technology neutral	Arqiva for national block. There are various regional licensees for the 3 sub

			national blocks.
32 GHz	2 x 756 MHz	Service/Technology neutral	Everything Everywhere MBNL BT MLL Telecom
40 GHz	2 x 1500 MHz	Service/Technology neutral	MBNL MLL Telecom UK Broadband

Table A.5.2 Auctioned bands

Band	Amount of spectrum	Current status
11 GHz (10.7-11.7 GHz)	1000 MHz	Used by the Fixed Satellite Service (s-E) for satellite receivers Contains legacy fixed links
14 GHz (14.25-14.5 GHz)	250 MHz	Band closed to new Fixed Services by the RA with respect to the forecasted increase in use by satellite applications, and the associated sharing issues. Currently used for satellite transportable earth stations Contains legacy fixed links
22 GHz (21.2-22 GHz)	800 MHz	21.4-22 GHz is reserved for future use by Broadcasting Satellite Service Contains legacy fixed links
50 GHz (49.2 – 50.2 GHz)	1000 MHz	Band returned to RA management from Cable and Wireless 49.44 to 50.2 GHz is identified for high density applications in the fixed satellite service in the space to Earth direction in Region 1 in accordance with the Radio Regulations footnote 5.516. Contains legacy fixed links

Table A.5.3 Closed bands¹⁴

¹⁴ There are operating fixed links in closed bands as shown in table A.5.3. In addition to the above closed bands there are a few links operating at 2GHz following historical band plans. There are also fixed links operating under some legacy band plans which have been overlaid with current band plans in accordance with OfW48

Annex 6

Current management approaches for fixed link spectrum in the UK

Overview of spectrum management techniques used with fixed links spectrum

A6.1 Approximately 37 GHz of spectrum is available in the UK for fixed point to point links. This includes a wide variety of bands ranging from 1.4 GHz to 86 GHz. As discussed in Section 2.8 this spectrum is made available to end users on a variety of bases. The extent to which these different models are used is illustrated in Figure A.6.1 below.

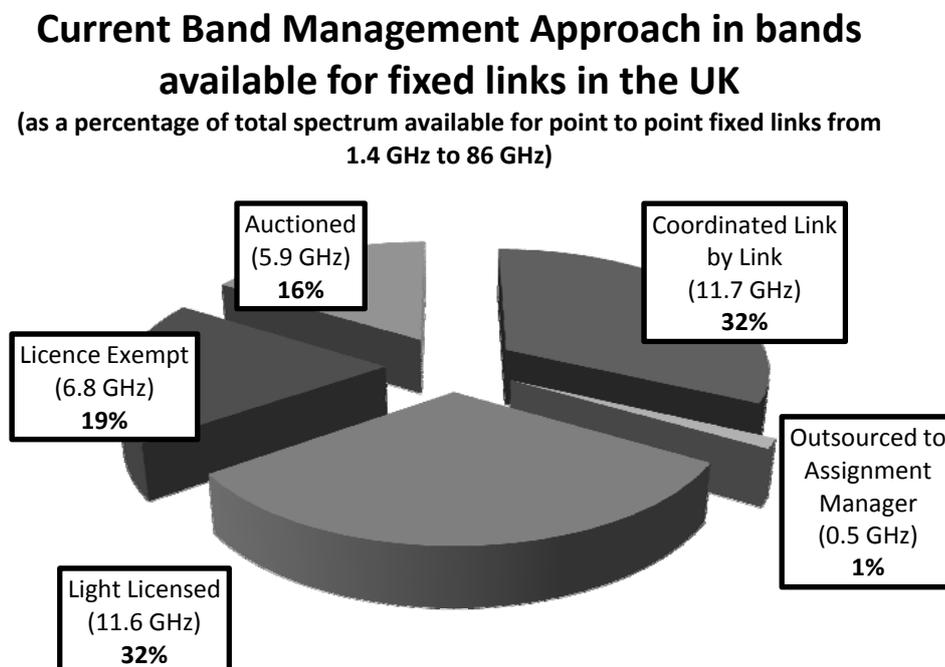


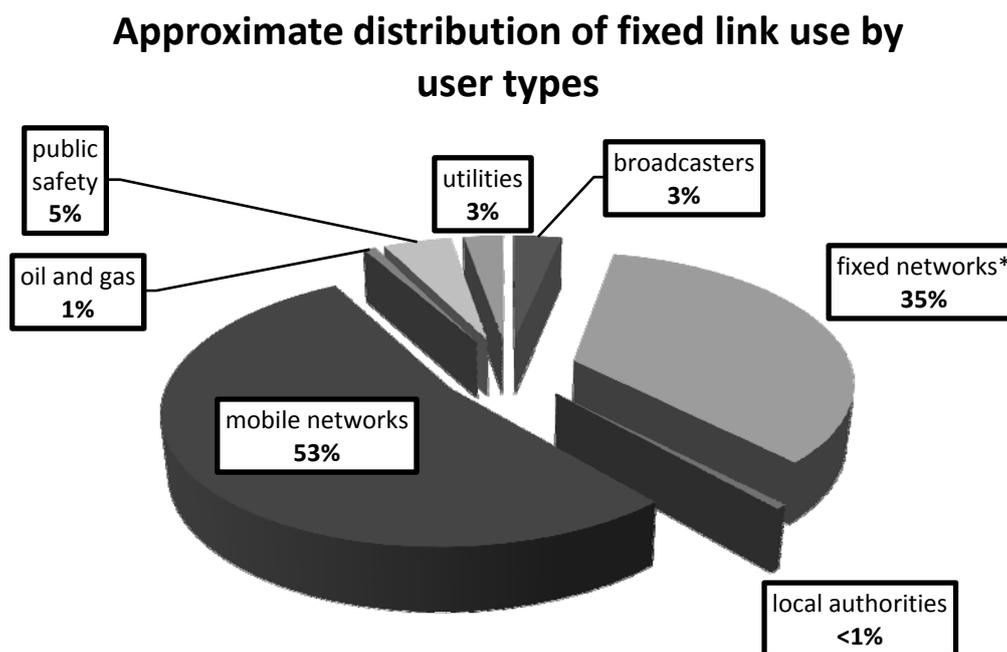
Figure A.6.1

The core focus of the review

A6.2 The core focus of the Band Review is on the future management of around 12 GHz of spectrum between 1.4 GHz and 55 GHz that is currently managed by Ofcom and made available on a technically coordinated basis, link by link. There are approximately 33,000 such links. Spectrum above 55 GHz is generally made available via lighter regimes or licence exemption where we expect the review will have limited impact on the current management approach. The light licensed bands are also relatively new and are occupied by a small number of links (approx 60 links).

Uses of fixed links spectrum

A6.3 Fixed point to point links are used by a variety of industry sectors. Figure A.6.2 below, based on analysis by the Aegis study, gives an approximate distribution of the user types within the bands which are coordinated on a link by link basis by Ofcom. The user types are based on the core business activity of the licensee. It can be seen that the predominant application is within mobile networks (for backhaul). In practice, the analysis understates the predominance of mobile network applications as many of the links assigned to fixed network operators are used to provide outsourced services to the mobile network operators.



* A large part of this use is for mobile backhaul

Figure A.6.2