Digital dividend: clearing the 800 MHz band

Statement

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Overview

The UK has been at the forefront in Europe in planning for and preparing to release a digital dividend – spectrum freed up for new uses by the switchover from analogue to digital terrestrial television. Between 2003 and 2008, Government decisions and our own Digital Dividend Review determined the configuration of the UK's digital dividend and set us on a course to award it under a market led approach. This, we believed, would maximise the total value to society that using the spectrum was likely to generate over time.

But an increasing number of European countries are now identifying a digital dividend of their own – the so-called 800 MHz band – and it is not quite the same as the UK's. Aligning with this emerging European approach would enable the UK to benefit from international economies of scale in equipment manufacture and fewer restrictions on how the spectrum can be used, particularly for the next generation of mobile broadband services. However it would also require us to move existing and planned authorised users of the 800 MHz band – a significant number of digital terrestrial television transmitters and the overwhelming majority of wireless microphones in the UK – to replacement spectrum. This would be a complicated and costly exercise with risks of disruption to those users and the citizens and consumers who rely on their services.

We assessed the costs and benefits of clearing the 800 MHz band in a consultation document that we published in February 2009. We concluded that this would bring significant net benefits – conservatively estimated at £2-3bn in net present value. We therefore proposed to clear the 800 MHz band, while putting in place clear measures to move affected users with the minimum of disruption.

Responses to the consultation broadly supported or accepted our proposals in the broader interests of citizens and consumers. They stressed the importance of successfully moving affected users to replacement spectrum and made many detailed comments about how we could best achieve this. At the same time, we were urged to clear the 800 MHz band without delay to ensure the benefits of new uses of the spectrum could be realised at the earliest possible date.

In light of these consultation responses and further analysis, **this statement confirms that we will clear the 800 MHz band in the UK**. It sets out a number of detailed decisions about moving digital terrestrial television and wireless microphones to replacement spectrum, with modifications to our original proposals where we agree these will better meet our objectives. And it signals our intention to engage in further, ongoing dialogue and consultation with key stakeholders in the months and years ahead, particularly as we prepare to award the digital dividend in the light of the Government's Digital Britain Final Report.

Section 1

Executive summary

Introduction

1.1 This statement sets out our decision to clear the 800 MHz band – 790-862 MHz, channels 61 to 69 in UHF Bands IV and V – of existing and previously planned users and align the upper band of the UK's digital dividend with the spectrum being identified for release by an increasing number of other European countries. It also sets out the high level principles for how we intend to clear those existing and previously planned users – digital terrestrial television (DTT) and programme-making and special events (PMSE) – from channels 61, 62 and 69.

1.2 The UK has been at the forefront within Europe in planning for and realising a digital dividend. In 2003, before Ofcom came into existence, the UK Government decided to release 112 MHz of this valuable spectrum when digital switchover (DSO) was complete. The plan then developed envisaged this dividend would comprise two distinct bands of spectrum:

- a smaller, upper band of 48 MHz at 806-854 MHz (channels 63-68); and
- a larger, lower band of 64 MHz at 550-630 MHz (channels 31-35, 37 and 39-40).

1.3 We have subsequently cleared aeronautical radar from channel 36 and plan to clear UK radioastronomy from channel 38 in 2012. This will extend the lower band to include the whole of 550-630 MHz (channels 31-40) and increase the total amount of cleared spectrum in the digital dividend to 128 MHz.

1.4 Between 2006 and 2007, our Digital Dividend Review (DDR) consulted on and set a clear strategy for the way in which we would release this spectrum. We concluded that by taking a market led approach and creating freedom and flexibility for users to make decisions about spectrum use, we were most likely to achieve our objective of maximising the total value to society that use of the digital dividend is likely to generate over time.

1.5 Other European countries are now setting out plans for their own digital dividends. The way in which they do this has important implications for us. In particular, the plans emerging across Europe have identified a larger (upper) band of spectrum than originally planned in the UK, comprising 72 MHz at 790-862 MHz (channels 61-69), also known as the 800 MHz band.

1.6 To date, Finland, Sweden, France, Switzerland, Germany, Spain and Denmark have decided to release the whole of the 800 MHz band, with others likely to follow. The reason behind this move is that this spectrum is likely to be particularly suitable for the provision of a new generation of mobile broadband services.

1.7 The fundamental question therefore facing the UK is whether we should align more of the spectrum being released as part of our digital dividend with the spectrum being released by an increasing number of other European countries.

1.8 The way in which we have approached this question is to consider options for clearing the spectrum, weigh up the costs and benefits of each and then decide

which option is likely to generate the greatest value for UK citizens and consumers over time.

Clearing the 800 MHz band

1.9 In our 2 February 2009 consultation document on clearing the 800 MHz band (the 800 MHz consultation)[1], we set out our cost/benefit analysis (CBA) of aligning the upper band of the UK's digital dividend with the 800 MHz band emerging across Europe. Our CBA concluded that very substantial net benefits could be realised through the proposed alignment. These benefits were estimated, conservatively, to be in the region of £2-3bn in net present value (NPV).

1.10 In particular, aligning the spectrum would mean that manufacturers could produce equipment for a mass market at a lower unit cost and users could enjoy greater freedom as neighbouring countries clear the same spectrum in a manner which reduces restrictions and enables more efficient use – in the UK and in other European countries.

1.11 Clearing the 800 MHz band in the UK would increase by 24 MHz the valuable spectrum that is made available in the upper band of the digital dividend for new uses. This has the potential for creating greater value for citizens and consumers as it is suitable for potentially high value services such as new mobile broadband technologies. Releasing more spectrum suitable for mobile services may also support a greater number of operators in the UK, in turn leading to greater competition, innovation and choice in the provision of high quality services.

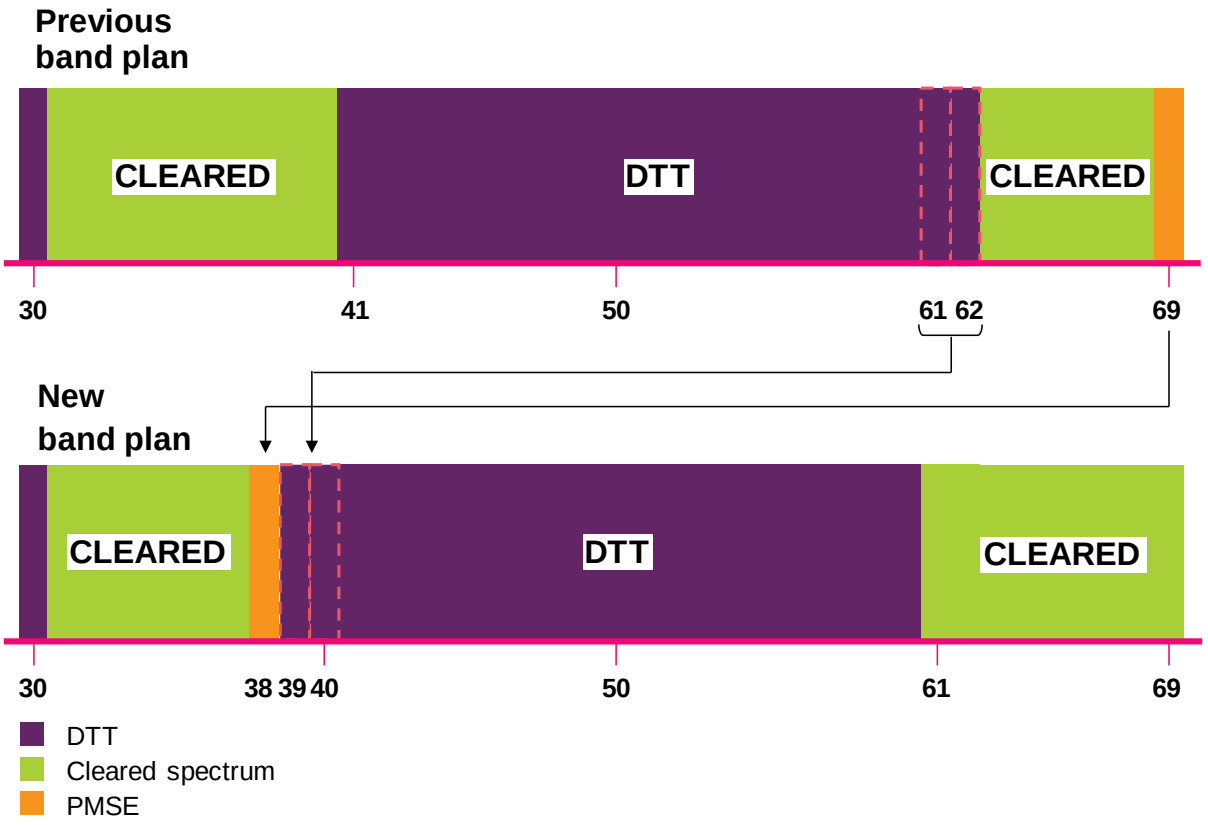
1.12 But clearing the 800 MHz band is not without costs. It involves short term costs as a result of moving DTT users from channels 61 and 62 and PMSE users from channel 69. It also has a longer term (albeit limited) impact on the amount of spectrum which is available for new services in the lower band of cleared spectrum, which is particularly suitable for additional DTT multiplexes. However, these two key sources of cost are limited when compared to the potentially significant benefits that could be delivered using this spectrum.

1.13 In light of our analysis of all the available evidence, including stakeholder responses following consultation, we believe it is in the interests of UK citizens and consumers that we proceed to clear the 800 MHz band and we have now decided to do so.

1.14 Figure 1 below illustrates the changes that will need to be made to the configuration of the UK's digital dividend. In effect, DTT in channels 61 and 62 will be moved into channels 39 and 40, and PMSE in channel 69 will be moved into channel 38. This means the cleared spectrum in the digital dividend will comprise 550-606 MHz (channels 31-37, the 600 MHz band) and 790-862 MHz (channels 61-69, the 800 MHz band).

[1] www.ofcom.org.uk/consult/condocs/800mhz/800mhz.pdf.

Figure 1. Changing the configuration of the UK's digital dividend



Moving DTT and PMSE from the 800 MHz band

DTT

1.15 The UK is now partway through DSO, a process which involves switching off analogue terrestrial broadcasting and substantially increasing the coverage of DTT so that current analogue coverage levels are matched. DSO is a very large and complex infrastructure and consumer communications programme affecting virtually every household in the UK. Its completion will free up the spectrum that forms the UK's digital dividend. Around 70% of households currently view DTT services on at least one television set – around 38.5% exclusively so.[2] These viewing levels are expected to continue to increase as DSO is rolled out.

1.16 We therefore consider it very important to protect the integrity of the DSO programme and ensure that any disruption to DTT viewers is minimised. In our consultation we proposed establishing three *DTT migration criteria* to help secure this outcome:

- there should not be a material adverse effect on DSO;
- existing authorised and planned users of channels 61 and 62 should not bear extra costs that must reasonably be incurred in order to clear the spectrum; and

[2] See "The Communications Market: Digital Progress Report – Digital TV, Q1 2009" (www.ofcom.org.uk/research/tv/reports/dtv/dtu_2009_01).

- any solution should be consistent with existing policy objectives for DTT coverage after DSO, and the process should aim to minimise the impact on viewers of broadcasts from the existing DTT multiplexes.

1.17 We received strong support from stakeholders to these proposed criteria. We have therefore decided to adopt the DTT migration criteria and we will develop plans for implementation with reference to these.

1.18 Our 800 MHz consultation considered three spectrum reorganisation options for moving DTT from channels 61 and 62. We proposed to adopt the two-step hybrid reorganisation option, which we believed was most consistent with the proposed DTT migration criteria. In light of responses which predominantly gave their support for this option, we have now decided to adopt the two-step hybrid option.

1.19 We have further concluded that integrating DTT clearance with DSO, wherever possible, is desirable. This will help reduce impacts on viewers and is likely to both expedite spectrum clearance and reduce clearance costs. Further work will be required to confirm the extent to which DTT clearance can be integrated with DSO. We still believe that it will be possible in a number of late switching regions. Nevertheless, it is clear that for a significant proportion of the UK, DTT clearance will need to be retrofitted. We believe that the end of 2013 remains a challenging but credible target for clearing DTT from channels 61 and 62.

1.20 We will publish more detailed plans for implementation later in the summer including details of programme management and governance arrangements and how the work will be coordinated with DSO. This will outline key milestones and decisions as well as how we propose that key stakeholders are represented in the decision making process. We will be in touch with the affected stakeholders very soon to discuss how this work will be taken forward and to pick up on specific issues affecting them.

1.21 Considerable further work will also be required to better define the costs associated with the clearance programme but we believe that the broad cost categories set out in the 800 MHz consultation are appropriate. We will further discuss these categories and the more granular costs which fall within each with affected stakeholders as well as considering whether other relevant costs exist.

1.22 As well as preparing for a major clearance implementation programme over the summer we will immediately instigate urgent work on a new frequency and transition plan for the clearance of DTT from channels 61 and 62. We will ensure that appropriate resources are made available so that this urgent planning work does not detract from ongoing DSO related work.

PMSE

1.23 We will award channel 38 to the band manager with PMSE obligations on the same terms as would have applied to channel 69. We make this decision in light of strong stakeholder support and our technical and economic assessment of the requirements of PMSE users.

1.24 Channel 38 is already available for and used by PMSE across much of the UK. We have agreed reduced protection zones with UK radioastronomers that will increase the usability of channel 38 for PMSE until 1 January 2012, from which point PMSE users will have access to this channel on a UK-wide basis. PMSE users will also have access to the 800 MHz band (including channel 69) until at least this date. Depending on the outcome of the work the Government has initiated to resolve the

key questions raised by the Independent Spectrum Broker's (ISB) report for Digital Britain, it may yet be possible for PMSE to continue to have access to some or all of the 800 MHz band up to the end of DSO in late 2012. The Government's timetable for this aspect of Digital Britain suggests there should be clarity on this issue in September 2009. PMSE users will continue to have access to channel 36 on 12 months' notice to cease and to the rest of the 600 MHz band until the end of DSO.

1.25 We will consult shortly on further details associated with funding eligibility and how access to channel 38 can best meet the needs of PMSE users.

Funding

1.26 We will put funding in place to ensure that existing authorised and planned DTT users of channels 61 and 62 and PMSE users of channel 69 do not bear the extra costs that must reasonably be incurred to clear the spectrum. The Government indicated in the Digital Britain Final Report, published on 16 June 2009, that it will meet these costs.[3] We are currently in discussion with HM Treasury on the most appropriate disbursement mechanisms for the funds, which we believe are essential to such a major programme of work. We believe the direct cost of clearing the 800 MHz band in the UK, although modest in comparison to the benefits, will amount to about £115-250m (NPV).

Next steps

1.27 Making changes to the UK's digital dividend has important implications for existing authorised and planned users of the 800 MHz band and the services they provide to citizens and consumers. We need to ensure a smooth transition of affected users to suitable replacement spectrum to avoid disrupting those services in clearing the band, which will be a challenging and complex process.

1.28 A key element of the implementation task we face is renegotiating international rights to use this spectrum. For the 800 MHz band, negotiations are already underway with neighbouring administrations to optimise (though not reserve) those rights for use by mobile services. We expect to complete these negotiations by mid 2010.

1.29 Negotiations to use the 600 MHz band have been made more complicated by these plans, given the need for careful planning to avoid interference to DTT services moving from the 800 MHz band and to ensure that current DSO plans are not materially disrupted. We are working towards having preliminary agreements in place by mid 2010.

1.30 We are grateful for the Government's support for clearing the 800 MHz band as expressed in the Digital Britain Final Report. We also note its endorsement of many of the ISB's proposals, and we will need to consider the implications for awarding the 800 MHz band following the completion of that process. Given the Government's timetable we anticipate that we will be in a position to set out how we expect to proceed with the 800 MHz, 600 MHz and geographic interleaved awards in the late autumn.

[3] www.culture.gov.uk/what_we_do/broadcasting/6216.aspx.

Section 2

Introduction

High level summary

2.1 On 2 February 2009, we published the 800 MHz consultation on whether to align some of the spectrum being released in the UK as part of our digital dividend with the spectrum being released in an increasing number of other European countries.

2.2 This statement describes the responses to the 800 MHz consultation and sets out our decision to proceed with the clearance of the 800 MHz band.

The UK's digital dividend

DTT and DSO

2.3 DTT was launched in the UK in 1998 and currently covers around 73% of UK households (compared with the 98.5% coverage achieved by four of the five analogue terrestrial television channels). There are six DTT multiplexes that collectively carry over 40 television channels, with some radio, digital text and interactive services.[4] The geographic coverage of the three PSB multiplexes will increase at DSO to mirror that currently achieved by analogue terrestrial television. Commercial multiplex coverage is also expected to increase at DSO to around 90%.

2.4 DTT is an important part of the UK broadcasting landscape with around 70% of households watching DTT on at least one television set – 38.5% watch DTT exclusively. As analogue terrestrial television switches off across the UK, it is likely that the importance of DTT as a means of accessing free-to-air PSB television content will increase.

2.5 DSO is a major programme many years in the planning that has involved very significant resources and will affect virtually every household in the UK. It is being implemented on a regional basis. It started with the Scottish Borders region in late 2008 and is expected to conclude in late 2012. The planning and execution of engineering changes to the terrestrial broadcast network (i.e. upgrading transmission infrastructure, decommissioning analogue equipment and installing new digital equipment) has been underway for several years. The nature of the network, with bespoke equipment and very tall masts (changes to which are contingent on weather conditions), requires lengthy ordering and engineering lead times. This means many of the network changes for DSO have already been committed, are in progress or have even been completed.

2.6 A very high-profile DSO consumer education and communications exercise is also under way. This exercise, involving broadcasters, Digital UK, the digital switchover help scheme (DSHS), the consumer electronics supply chain and others, has been in progress since 2005, when Digital UK was formed. Any material adjustments to the DSO programme (e.g. to alter its timing in some areas) could cause confusion and potential dissatisfaction among viewers, many of whom have already upgraded

[4] Three multiplexes carry public-service broadcasting (PSB multiplexes) – Multiplexes 1 and B operated by the BBC and Multiplex 2 operated by Digital 3&4. Three multiplexes carry commercial services only (commercial multiplexes) – Multiplex A operated by SDN and Multiplexes C and D operated by Arqiva.

television reception equipment[5] in order to receive DTT services in advance of DSO (or in anticipation of doing so where viewers lie outside existing coverage areas). As with DSO itself, those most at risk are likely to be the elderly and the vulnerable.

The Digital Dividend Review

2.7 In January 2003, before Ofcom was established, the UK Government decided that 14 channels, each of 8 MHz of spectrum, in UHF Bands IV and V would be cleared of analogue terrestrial television through DSO and made available for new uses.

2.8 The plan developed at that time envisaged a digital dividend comprising two distinct bands:

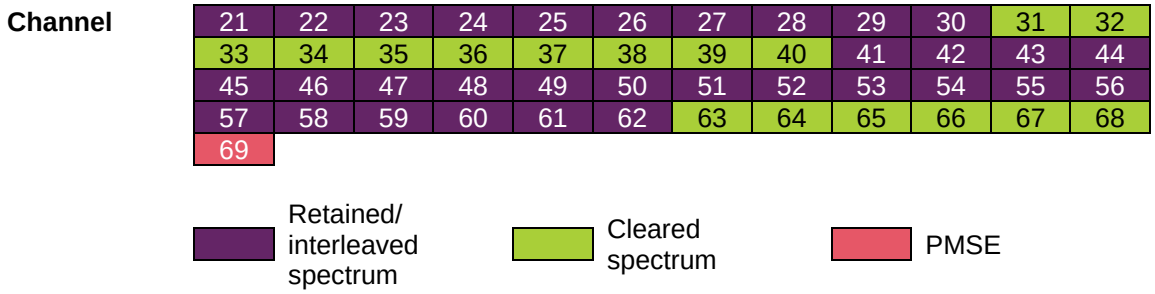
- a smaller, upper band of 48 MHz at 806-854 MHz (channels 63-68); and
- a larger, lower band of 64 MHz at 550-630 MHz (channels 31-35, 37 and 39-40).

2.9 We have subsequently acted to clear aeronautical radar from channel 36 during 2009 (this has now taken place) and radioastronomy from channel 38 during 2012. This extends the lower band to include the whole of 550-630 MHz (channels 31-40) and increases the total amount of cleared spectrum in the digital dividend to 128 MHz.

2.10 We conducted a major review of our strategy for the release of this spectrum – the DDR – during 2005-07. The DDR also considered the future of a significant amount of capacity available within the spectrum (channels 21-30 and 41-62) that would be retained to carry the six DTT multiplexes after DSO. This is known as interleaved spectrum because only a small amount of this spectrum in any particular location will be used for DTT and so is available for other services on an interleaved (or geographically fragmented) non-interference basis.

2.11 Figure 2 sets out the existing plan for UHF Bands IV and V after DSO. This includes continued use of channel 69 for PMSE, primarily for wireless microphones.

Figure 2. Existing plan for UHF Bands IV and V after DSO



The importance of the digital dividend

2.12 The digital dividend is of great importance because the spectrum concerned provides a very attractive combination of capacity (bandwidth) and coverage (signals travel over long distances and readily penetrate buildings). This, in turn, means it can be used for a wide range of new wireless communications services. These include additional DTT channels (whether in standard definition – SD – or high definition – HD), two-way mobile services (including mobile broadband), mobile multimedia (including mobile TV), PMSE and potentially others.

[5] This includes set-top boxes, integrated digital televisions and digital television recorders.

2.13 As a consequence, the digital dividend provides opportunities for both new entry into existing markets and the introduction of new services, promoting competition and innovation in downstream markets in the interests of citizens and consumers.

The DDR statement

2.14 We set out our approach to awarding the digital dividend in a statement published on 13 December 2007.[6] This followed two years of analysis, market research and consultation that demonstrated there was significant demand for this spectrum from a wide range of services.

2.15 Our main decision was that, in general, we should take a market-led approach to releasing the digital dividend. This would allow users to make decisions about how the spectrum should be used and create more flexibility for the use of the spectrum to change in response to shifts in consumer demand and technology. It would also create stronger incentives for efficiency and (provided the award was well designed) increase opportunities to bring more competition and innovation into the communications sector.

2.16 Consistent with this view, we concluded that our approach to releasing the spectrum should be based on service and technology neutrality, and that we should impose the minimum restrictions on use of the spectrum necessary to prevent harmful interference and meet the UK's international obligations.

2.17 Throughout the DDR, we have stressed that our objective is to maximise the total value to society that using this spectrum is likely to generate over time. This includes not just the value that each of us derives as a consumer of services but also the wider value that wireless communications services can create by contributing to broad social goals like inclusion and promoting informed democracy. It is not our objective to raise revenue from managing the spectrum, nor, given our statutory duties, is this a relevant consideration for us.

2.18 We set out detailed proposals for the award of both the cleared and the interleaved spectrum in summer 2008. Among these was a proposal to include the interleaved spectrum in channels 61 and 62 (790-806 MHz) in the cleared award. We noted that this would help to reflect the outcome of the World Radiocommunication Conference 2007 (WRC-07) and potential European interest in a digital dividend (see below). The cleared award would therefore consist of 128 MHz of cleared spectrum and 16 MHz of interleaved spectrum. We published our proposals for the detailed design of the cleared award on 6 June 2008.[7]

International developments

World Radiocommunication Conference 2007 and Geneva 2006

2.19 World Radiocommunication Conferences are held periodically by the International Telecommunication Union (ITU), which is an agency of the United Nations. One of their main purposes is to agree revisions to the ITU Radio Regulations (ITU-RR), which constitute an international treaty between ITU members. We represent the UK in the ITU under a Government direction.

[6] www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf.
[7] www.ofcom.org.uk/consult/condocs/clearedaward/condoc.pdf.

2.20 WRC-07 took place from 22 October to 16 November 2007. One of the main agenda items considered at the meeting related to changes to the ITU-RR that could facilitate the provision of mobile systems in the future. WRC-07 considered several proposals to add a co-primary (with broadcasting) mobile allocation to UHF Bands IV and V and agreed to this for the 800 MHz band in Europe, the Middle East and Africa. This allocation will come into effect from 17 June 2015.

2.21 The outcome of WRC-07 is of limited direct significance to the UK. This is because the UK's existing international agreements already provided flexibility for the UK to use UHF Bands IV and V for services other than broadcasting. This was, in particular, one of the outcomes agreed between the UK and many other countries at the Regional Radio Conference 2006 (RRC-06) held in Geneva.[8]

2.22 It is also important to note that the ITU-RR do not, in general, specify how ITU members should use spectrum. Instead, the principal obligation they create relates to the protection that members must give to the use of spectrum in other countries.

2.23 However, the decisions taken at WRC-07 are still of considerable indirect importance to the UK. This is because the outcome was seen by many as sending a clear signal that the 800 MHz band would be used for mobile services in the future.

Europe

2.24 An increasing number of other European countries are now following the UK's example by creating a digital dividend and planning to release it in a way that will allow new services – in particular new generations of mobile technology – to be deployed. However, these countries' plans differ in one important respect from the decisions we set out in the DDR statement: they comprise the whole 800 MHz band at the upper end of UHF Band V.

2.25 This reflects the fact that it now seems clear this spectrum is likely to be particularly suitable for the deployment of new mobile services. This is for two reasons in particular. The first is the signal sent by WRC-07, discussed above. This signal has increased the technical, commercial and regulatory momentum behind potential use of the 800 MHz band for new mobile services. The second reason is more concrete and technical. It is that using the upper end of UHF Band V for new mobile services means there is only one adjacency with broadcasting services (i.e. at the lower edge of the 800 MHz band). This is likely to reduce the cost and difficulty of managing interference. Use of other parts of UHF Bands IV and V for mobile services remains technically possible, but the cost of preventing harmful interference is likely to be greater if more than one boundary with broadcasting needs to be managed.

2.26 The other European countries that have already publicly identified the 800 MHz band as their digital dividend are:

- Sweden on 19 December 2007;
- Finland on 19 June 2008;
- France on 20 October 2008;

[8] RRC-06 was another important ITU conference. It created a detailed new framework – known as Geneva 2006 (GE06) – for the use of UHF Bands IV and V to enable the transition from analogue to digital broadcasting in Europe, the Middle East and Africa.

- Switzerland on 13 November 2008;
- Spain on 2 June 2009;
- Germany on 12 June 2009; and
- Denmark on 22 June 2009.

2.27 These countries have a combined population of 222 million, and others are likely to follow. Population – or, more specifically, market size – is important because it affects manufacturers' ability to realise economies of scale and so set lower prices for network and handset equipment.

European Union

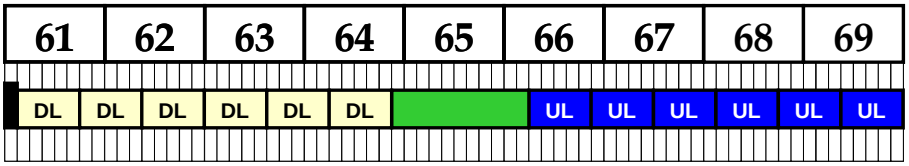
2.28 There has already been significant debate within the European Union (EU) about a common approach to the use of the digital dividend.[9] This has accelerated in the last few months. Technical work in the European Conference of Postal and Telecommunications Administrations (CEPT) in response to the European Commission's second digital dividend mandate is now drawing to a close.

2.29 In particular, CEPT's Electronic Communications Committee (ECC) considered the results of the various work items developed in response to the mandate in the week commencing 22 June 2009. These consisted of channel plans, least restrictive technical conditions, studies on cross border coordination, PMSE use and measurements of DTT receiver performance.

2.30 The ECC Project Team on IMT Matters (PT1) finalised a band plan optimised for mobile services using frequency-division duplexing (FDD) in the 800 MHz band and submitted this to ECC. As shown in figure 3, it proposed a paired arrangement of 2 × 30 MHz based on a block size of 5 MHz, with a 1 MHz guard band at 790-791 MHz and an 11 MHz duplex split at 821-832 MHz.

2.31 PT1 also provided guidance on other frequency arrangements for countries that do not wish to use the harmonised arrangement or do not have the full 800 MHz band available. These include an unpaired frequency arrangement for mobile services using time-division duplexing (TDD) based on a block size of 5 MHz, with a 7 MHz guard band at 790-797 MHz, and the possibility to mix both TDD and FDD frequency arrangements.

Figure 3. PT1 FDD band plan for the 800 MHz band



2.32 Project Team SE42 has finalised the least restrictive technical conditions for two way fixed/mobile use of the 800 MHz band and, in cooperation with PT1 and Task Group

[9] See the European Commission Communication of 13 November 2007 (http://ec.europa.eu/information_society/policy/ecomm/doc/library/proposals/com_dd_en.pdf), the conclusions of the Council of Ministers of 12 June 2008 (http://register.consilium.europa.eu/pdf/en/08/st10/st10820.en08.pdf) and the resolution of the European Parliament of 24 September 2008 (www.europarl.europa.eu/oeil/FindByProcnum.do?lang=2&procnum=INI/2008/2099).

4 (TG4), produced an ECC Decision which addresses both the channel plans and technical conditions based on the block edge mask concept. In parallel, TG4 produced guidelines on cross border coordination, continuation of PMSE use and measurements of DTT receiver performance. All of these draft CEPT reports and the ECC Decision were approved by the ECC subject to a public consultation process. Final adoption for publication can be expected in October 2009.

2.33 On the policy side, the Radio Spectrum Policy Group is consulting on a draft Opinion on the digital dividend.[10] This recommends that the Commission assess options for a coordinated non-mandatory EU approach to the availability of the 800 MHz band and do so as quickly as possible – no later than 31 October 2009 – to minimise EU level uncertainty around Member States' ability to release the band. The draft Opinion also sets out a number of principles including respect for service and technology neutrality and adherence to CEPT's work in any EU harmonisation of technical elements.

2.34 Meanwhile, the Commission has appointed consultants to identify and evaluate options for a coordinated EU approach.[11]

2.35 In the light of all these inputs, we expect that the European Commission will consult on and subsequently adopt proposals toward the end of 2009. At this stage, neither the nature nor content of those proposals is clear, including whether they would be binding on Member States if agreed. The ensuing timetable for EU action will depend on the proposals that the Commission adopts.

Implications for the UK

2.36 The emerging plans of other European countries including at the EU level differ from the UK's in that they envisage clearing the whole 800 MHz band (channels 61-69), not just channels 63-68. In time, some European countries may also create a dividend elsewhere in UHF Bands IV and V, but none currently has plans in this respect, and we think it unlikely that a common approach will be taken.

2.37 Many respondents to our June 2008 cleared award consultation – principally those with an interest in the potential use of the 800 MHz band for new mobile services – argued for channels 61, 62 and 69 to be cleared of their current planned use after DSO so we could award the same spectrum as other European countries. Without alignment, they said the UK risked being a subscale market that manufacturers and service providers would either not enter or only be able to do so at an increased cost that would ultimately be borne by citizens and consumers.

2.38 In the 800 MHz consultation, we assessed the benefits and costs of clearing the whole 800 MHz band compared with awarding only the cleared spectrum presently in the UK's digital dividend. We concluded that clearing the whole 800 MHz band is likely to be strongly in the interests of citizens and consumers. The net benefits of clearance are positive in all the scenarios we modelled and very large in the scenarios that we regarded as more likely.

2.39 However, clearing these channels in the UK is likely to be a lengthy, complex and resource-intensive process. A task of this scale inevitably carries some risks, which will need to be managed carefully by all interested parties. Sections 4 and 5 set out

[10] http://rspg.ec.europa.eu/_documents/documents/meeting/rspg19/rspg09_272_draft_Opinion_digitaldividend.pdf.
[11] www.analysysmason.com/Consulting/Services/Strategy-consulting/Regulation-and-policy-development/Spectrum-management/Digital-dividend/Exploiting-the-digital-dividend--a-European-approach/.

our plans, following consideration of stakeholder responses, for implementing this change, accommodating users of channels 61, 62 and 69 in alternative spectrum (channels 38-40 at the top of the 600 MHz band) and the considerations that we believe are key to successful implementation.

Structure of this document

2.40 This statement sets out our decision to clear the 800 MHz band and align the upper band of the UK's digital dividend with the spectrum being identified for release by an increasing number of other European countries. It also sets out the high level principles for how we intend to clear DTT and PMSE from channels 61, 62 and 69.

2.41 In their responses to the 800 MHz consultation, stakeholders raised a number of detailed implementation issues. Some we address in this statement. Others, of a more detailed nature, will be addressed in our implementation plans for DTT and PMSE. One key aim of our plans will be to clear channels 61, 62 and 69 in a way that minimises disruption to existing authorised and planned users of this spectrum and, ultimately, the citizens and consumers who use their services.

2.42 Section 3 of this statement sets out the costs and benefits of clearing the 800 MHz band and the options we have considered. This is supported by the impact assessment in annex 2 and the economic modelling described in annex 3. Sections 4 and 5 set out our decisions to move DTT and PMSE respectively.

2.43 Section 6 explains how we intend to secure the UK's interests in negotiations with neighbouring countries to enable both us and them to clear the 800 MHz band. Section 7 sets out our conclusions and next steps, including the timetable for clearing and awarding the 800 MHz band.

Section 3

The costs and benefits of clearing the 800 MHz band

Introduction

3.1 This section considers views expressed by respondents to question 1 in the 800 MHz consultation, which asked whether they agreed that clearing DTT and PMSE to align the upper band of cleared spectrum in the UK with the emerging digital dividend in other European countries was likely to further the interests of citizens and consumers to the greatest extent.

3.2 We begin by discussing our policy conclusions on the benefits and costs of clearing the 800 MHz band compared with maintaining the configuration planned to date (the base case). We go on to discuss the views expressed by stakeholders in relation to the above question and then set out our conclusion on whether clearing the 800 MHz band furthers the interests of citizens and consumers to the greatest extent.

3.3 A detailed impact assessment and an explanation of our economic modelling, which underpins the analysis in this section, are set out in annexes 2 and 3 respectively.

3.4 Clearing the 800 MHz band will be a large, complex project with some associated risks. It is imperative that we identify the key risks and consider carefully how best to manage and mitigate them. Sections 4 and 5 set out how we intend to do so for DTT and PMSE respectively. Our overall objective for the digital dividend remains to maximise the total value to society that using this spectrum is likely to generate over time. However, for the purpose of assessing the case for clearance, we believe it is important to take account of two further secondary objectives:

- minimising disruption to existing and planned authorised users of the 800 MHz band after DSO; and
- ensuring the timely award of this spectrum so citizens and consumers can start reaping the benefits as soon as possible.

Preferred option

3.5 We set out in the impact assessment for the 800 MHz consultation a number of options that we believed could achieve our objective for the digital dividend. (See annex 5 of that document for further details.) In summary, these were:

- continuing with the existing plan;
- clearing DTT from channels 61 and 62 in isolation;
- clearing PMSE from channel 69 in isolation; and
- clearing both DTT and PMSE from the 800 MHz band.

3.6 Our analysis demonstrated that the last option – clearing the whole 800 MHz band – provides the greatest benefit to UK citizens and consumers.

3.7 We have considered all of these options carefully. However, it is important to understand that, in practice, we do not consider it likely to be tenable simply to proceed with the cleared award in its existing configuration on the timelines previously proposed. The reason for this is that some neighbouring countries have already asked us to renegotiate the GE06 Plan agreed at RRC-06 on a bilateral basis. We have received these requests because these other countries also wish to clear the 800 MHz band.

3.8 These international agreements are very important because they set the "envelope" within which the UK enjoys rights to use spectrum. It is therefore desirable to know the contents of these international agreements (at least to a certain level of detail) before awarding, for example, the cleared spectrum.

3.9 In theory, we could refuse to negotiate with our neighbours and insist on our GE06 assignments. However, we do not regard that as a realistic or sensible course of action for the UK. Successful spectrum management in a crowded environment such as Western Europe requires good cooperation between different countries, and we do believe it is in the UK's interest to adopt such an approach for this spectrum. We therefore need to enter these negotiations in a constructive and purposeful manner in order to secure the greatest benefits for UK citizens and consumers. Section 6 explains how we intend to do this.

3.10 The significance of this point is that it means our analysis of the base case is relatively optimistic (i.e. it will tend to overstate the benefits of the base case compared to the alternatives).

3.11 The rest of this section sets out our analysis of the option that, in our view, furthers the interests of citizens and consumers to the greatest extent: clearing the whole 800 MHz band.

Clearing the 800 MHz band

3.12 Figure 4 sets out the configuration of the 800 MHz band after DSO as currently planned in the UK and compared to that emerging in other European countries.

Figure 4. Current UK and emerging European plans for the 800 MHz band

DTT		UK upper digital dividend						PMSE
61	62	63	64	65	66	67	68	69
Emerging European digital dividend								

3.13 Aligning the upper band of cleared spectrum in the UK with the digital dividend in other European countries requires us to clear DTT from channels 61 and 62 and PMSE from channel 69.[12]

3.14 The costs of clearing DTT and PMSE are substantially independent of each other. We have therefore considered the likely benefits that would accrue if only one use were cleared. The results, as set out in more detail in annex 2, demonstrate the case for clearing either use is strong. However, the greatest benefits arise from the synergy of clearing both uses from all three channels concurrently. In this section, we therefore focus on describing the relevant benefits and costs of this option.

[12] We recognise that there is some (albeit limited) interleaved PMSE use of channels 61 and 62. This, too, will need to be cleared from those channels.

Benefits

3.15 Clearing the 800 MHz band could deliver incremental benefits within a range of £2-£3bn,[13] with benefits materialising through:

- **lower equipment costs**. As more European countries clear the 800 MHz band and release it in a way that enables new uses, it becomes possible for manufacturers to realise greater economies of scale, reducing prices for network and handset equipment. The bulk of these benefits should flow to UK citizens and consumers provided markets are competitive;

- **fewer restrictions on spectrum use**. As neighbouring countries seek to clear the same spectrum, we can renegotiate existing international agreements in a way that reduces restrictions and so enables more efficient spectrum use in both the UK and other parts of Europe;

- **more valuable spectrum made available**. The changes proposed in the 800 MHz consultation would add 24 MHz to the spectrum available for new uses in the upper band of the digital dividend while removing 24 MHz from the spectrum available for new uses in the lower band. We believe this will create more value for citizens and consumers overall because new uses in the upper band are likely to generate more value. This is because the spectrum in the upper band is particularly suitable for uses such as new generations of mobile broadband technology, and because spectrum below 1 GHz for these uses is particularly scarce;[14] and

- **increased competition**. The availability of more spectrum suitable for mobile services might support a greater number of operators. This might, in turn, lead to greater competition in the provision of those services, yielding lower prices, higher quality and greater choice.

3.16 We assessed the size of some of these benefits in a range of scenarios that capture a wide range of possible demand for the cleared spectrum as a whole over the longer term. We deemed the following to be the two most likely scenarios:

- strong demand for mobile communications (over the longer term); and

- strong demand for all services (over the longer term).[15]

Costs

3.17 There are costs and risks associated with clearing the 800 MHz band. However, we believe DTT can be moved from channels 61 and 62 to channels 39 and 40 in such a way as to minimise disruption to viewers (see section 4). Similarly, we believe channel 38 affords a suitable alternative (i.e. an 8 MHz channel soon to be usable UK-wide) to channel 69 for PMSE (see section 5).

[13] Further details of how we estimate the net incremental range are set out in paragraph A2.26 in the Impact Assessment and Table A7 in the modelling annex.
[14] This reflects in part the fact that only 70 MHz of spectrum below 1 GHz is otherwise available for mobile services while 256 MHz will be in use for DTT after DSO. The scarcity of high-quality spectrum for mobile services increases its incremental value.
[15] We have also used a third (and most unlikely) scenario to test our modelling outputs. For this scenario, we envisaged strong demand for DTT and relatively weak demand for mobile services.

Effect on cleared spectrum suitable for DTT

3.18 Our plans to clear channels 61 and 62 will lead to the use of channels 39 and 40 as a substitute for the six existing DTT multiplexes in the UK (provided international negotiations grant the necessary clearances). The net effect would be less spectrum in the lower band of cleared spectrum suitable for new UK-wide DTT services. However, through careful planning and implementation, there should be enough capacity in the new lower band to support a further two multiplexes with up to 90% coverage. Any decision on the design and implementation of such a multiplex would obviously be a matter for any acquirer of the spectrum, who would have to make a trade-off between coverage and capacity. The cost of this in terms of potential loss to future DTT services in the lower band is dependent on how much spectrum new DTT services would be likely to win at auction.

3.19 In addition, as more DTT moves below channel 61 in the UK and neighbouring countries in order to clear the 800 MHz band, channels 21-60 will become more intensively used. This may reduce the suitability of interleaved spectrum for local TV. The materiality of this impact will be highly dependent on the exact outcomes of international negotiations and the coordination and UK planning arrangements that flow from them. However, we continue to believe there is likely to be suitable interleaved spectrum available which could be used for local TV. Therefore for the purposes of our assessment at this stage, we have assumed there will be no significant impact on this use in aggregate (see annex 2 for more details).

Implementation costs

3.20 There are direct implementation costs associated with:

- the necessary technical, engineering and planning work required to move DTT and PMSE from the 800 MHz band to new spectrum; and
- minimising impacts on citizens and consumers including:
  - DTT viewers and
  - PMSE users.

Clearing DTT from channels 61 and 62

3.21 To clear DTT from channels 61 and 62, we considered three options:

- **a one-step option**. This is in effect a direct replacement of channels 61 and 62 with channels 39 and 40;
- **a two-step option**. This involves a systematic move of assignments in channels 61 and 62 to channels 48 and 51, with assignments in those channels having first been moved to channels 39 and 40; and
- **a hybrid option**. This is comparable to the two-step option but allows a wider set of channels to which assignments in channels 61 and 62 would be moved.

3.22 All three options are discussed in greater detail in section 4. We have decided to adopt the hybrid option as it has the least impact on coverage and requires little or no adjustment to existing household aerials. We estimate the cost of implementing this option lies in the range of £100-220m (NPV). We will decide the exact nature of the

hybrid option (i.e. which channels will be involved) in our implementation plan which we will publish in the autumn.

3.23 A detailed summary of stakeholder views on our proposals for clearing DTT from channels 61 and 62 is set out in section 4.

Clearing PMSE from channel 69

3.24 In the cleared award consultation, we suggested that channel 69 in isolation was of limited value to PMSE users because many touring companies, who generally use channel 69, need to use more than 8 MHz to fulfil demand. In subsequent discussions with PMSE stakeholders, we have been informed that a large number of users continue to place great importance on the availability of UK-wide, interference-free spectrum able to accommodate at least eight wireless microphones.

3.25 Those discussions also sought to identify long-term alternatives to channel 69. We have evaluated six possibilities against three considerations:

- **technical**. Could the spectrum be used without interference by wireless microphones? How many microphones could use it? Would microphones interfere with adjacent users?

- **coverage**. Could the spectrum be used by wireless microphones across the UK? How close would it be to other spectrum usable by microphones? When would the spectrum be available for use by microphones? and

- **economic**. What other uses of the spectrum would be displaced by wireless microphones? How valuable would they be to citizens and consumers? What would the likely costs for PMSE users be?

3.26 We have decided that channel 38 is the best alternative as it can provide 8 MHz of spectrum on what will soon be a UK-wide basis. In addition, it will be next to interleaved spectrum in and above channels 39 and 40 as a result of our favoured option for clearing DTT from channels 61 and 62 (see above). Section 5 contains a detailed analysis of all six possibilities as well as consideration of transitional arrangements (including funding) to ensure an orderly migration from channel 69.

3.27 Section 5 also includes a more in-depth discussion of stakeholder views expressed on our proposals to clear channel 69 and the implications for PMSE.

3.28 We estimate the cost of implementing this option lies in the range of £15-30m (NPV).

Funding

3.29 In the 800 MHz consultation we explained that the existing and planned authorised users of channels 61, 62 and 69 should not bear extra costs they must reasonably incur in clearing this spectrum. We stated our view that funding should be made available for costs efficiently and legitimately incurred to make these changes and that we would need to comply with any state aid rules to the extent they are relevant.

3.30 Our views as set out above still hold. Since publication of the 800 MHz consultation, we have discussed with the Government the level of funding and the types of mechanisms that will need to be put in place to administer the funds. At this stage, the Government has agreed in principle that public funding will be available to clear the 800 MHz band. This was set out in the Digital Britain Final Report.

3.31 Our discussions with the Government on the level of funds required and how they will be disbursed are continuing. We will publish details of the funding schemes for clearing DTT and PMSE from the 800 MHz band, including how they will be administered and who will qualify, as part of our implementation plans.

Responses to our proposal to clear the 800 MHz band

3.32 In the 800 MHz consultation, we asked the following question:

Question 1. Do you agree that clearing DTT from channels 61 and 62 and PMSE from channel 69 to align the upper band of cleared spectrum in the UK with the emerging digital dividend in other European countries is likely to further the interests of citizens and consumers to the greatest extent?

3.33 We received comments from a wide range of stakeholders across the communications sector. In general, stakeholders supported or accepted our proposals to clear the 800 MHz band.

3.34 The telecommunications sector – mobile network operators (MNOs), telecoms providers, technology firms and equipment manufacturers – strongly supported our proposals to clear the 800 MHz band and urged us to do so as soon as possible after DSO. Some argued for regional clearance of the spectrum to enable early deployment of services.

3.35 The majority of stakeholders representing the broadcasting sector (broadcasters, multiplex operators, Digital UK and Arqiva) acknowledged that, on balance, clearing the 800 MHz band was in the interest of UK citizens and consumers. They did however highlight concerns about the scale and complexity of the task of clearing DTT from channels 61 and 62, the potential risk of derailing DSO if it was not managed carefully and the possibility that clearance might not be completed until 2014. Some broadcasters and multiplex operators also felt that we had downplayed the impact of consumer uncertainty due to the need for a large number of households to undertake retuning. They also raised the possible knock on effects that this could have on the viability of the DTT platform itself through a possible loss of coverage and reduced competitiveness against other digital platforms. They considered that these impacts warranted compensation for broadcasters.

3.36 With regards to the impact of retuning, we have commissioned a study to help ascertain the exact scale (and cost) of retuning and also the type of consumer advice and support that will need to be put in place to help consumers/viewers. We discuss these issues further in section 4.

3.37 The majority of PMSE respondents cautiously accepted our proposals to clear channel 69 but sought early clarity on its replacement and also raised concerns about our proposed eligibility criteria for funding.

3.38 A small number of PMSE respondents opposed our proposals claiming that we had ignored the value of PMSE and that the amount of spectrum for PMSE use had actually decreased. This is discussed further in section 5.

3.39 One PMSE stakeholder questioned the validity of our market led approach and the potential impact this could have on PMSE users. Whilst we note these concerns, we have taken considerable steps to address the impact of a market led approach on PMSE users over the last two years. A key element of our work is to put in place a band manager, via a beauty contest, with obligations to PMSE users, including to

meet reasonable demand for spectrum on fair, reasonable and non-discriminatory terms as they move towards a market based approach. We published our most recent consultation document on this award on 22 June 2009.[16]

3.40 Virgin Media advised us of a potential interference problem that new two way mobile services in the 800 MHz band may cause to its cable network and set top boxes. It also suggested that DTT receivers may be similarly vulnerable. Virgin Media claimed that this could be raise significant costs to it and its customers and should be included in the CBA.

3.41 Our understanding is that this is an issue of electromagnetic compatibility between cable systems and any new services using the 800 MHz band. In particular, imperfect screening in cabling or other parts of the receive system may allow energy radiated from mobile transmitters in close proximity to cause interference to TV reception. This would still occur regardless of any decision to clear the 800 MHz band and therefore it is not appropriate for it to be included in this CBA. However, we recognise that interference into either cable TV set top boxes or DTT receivers could adversely disrupt reception for viewers of either service. Virgin Media is currently investigating the extent of this problem in the UK, where we understand the main distribution elements of its cable network to be less susceptible to interference than cable networks in other European countries because the majority of it is underground. At the same time we are conducting our own studies to evaluate the potential for interference problems and exploring what mitigating measures, if they prove to be required, are likely to be suitable and available.

3.42 A number of respondents, including the MNOs and BT, agreed with our proposal to clear the 800 MHz band, but argued that we had not assessed the cost of delay to clearing the spectrum for new use and that we should take all reasonable steps to clear the spectrum as soon as possible after DSO.

3.43 We have now modelled the impact of a one year delay to releasing the 800 MHz band beyond DSO. A detailed explanation is set out in the impact assessment in annex 2. We also address a number of other respondents' comments in the impact assessment in annex 2.

Conclusion

3.44 Having carefully considered stakeholder responses to the 800 MHz consultation, we have decided to press ahead with our proposals to clear the 800 MHz band.

3.45 Under the most plausible demand outcomes, we assess the net benefits of clearing the 800 MHz band to be within a range of £2-3bn. They are greatest if both DTT and PMSE are cleared at or around the same time.

3.46 We therefore conclude that aligning the upper band of cleared spectrum in the UK with the emerging digital dividend in other European countries has the potential to generate significant value over time for citizens and consumers, with net positive impacts on most stakeholders.

3.47 We are confident that we can mitigate and manage any short-term disruption to stakeholders by putting in place appropriate arrangements, including funding where, and to the extent, appropriate.

[16] www.ofcom.org.uk/consult/condocs/bandmanager09/bandmanager09.pdf.

Section 4

Moving DTT

Introduction

4.1 In section 3 we set out our conclusion that we should proceed with the clearance of the 800 MHz band. This will require the clearance of DTT from channels 61 and 62 and moving those services to alternative assignments in the 600 MHz band. In this section, we review the consultation responses and set out our decisions on how we intend to undertake this task.

4.2 In section 2, we set out the context that terrestrial broadcasting is moving, through DSO, to a DTT only platform meaning that more services will be provided using less spectrum. We note that DSO is a complex and resource intensive engineering and consumer education programme that is now in full swing and that international coordination has been a crucial input for taking decisions about the network infrastructure plans within it. It is therefore important that any further movement of DTT assignments is carefully coordinated with DSO.

4.3 Below we summarise our proposals on clearing DTT from channels 61 and 62 and the responses we received[17]. We also set out our decisions on these issues and our plans for taking this work forward, highlighting the issues that we will be considering further as part of our plans for implementation. We expect to prepare and publish these plans later in the summer.

DTT migration criteria

Our proposals

4.4 In addition to our policy objective to ensure the timely award of the digital dividend, we proposed in the 800 MHz consultation that any plan to clear DTT from channels 61 and 62 should meet certain *DTT migration criteria.* The criteria, designed to minimise disruption to existing users, were:

- there should not be a material adverse effect on DSO;
- existing authorised and planned users of channels 61 and 62 should not bear extra costs that must reasonably be incurred in order to clear the spectrum; and
- any solution should be consistent with existing policy objectives for DTT coverage after DSO, and the process should aim to minimise the impact on viewers of broadcasts from the existing DTT multiplexes.

4.5 We sought views on our DTT migration criteria as follows:

[17] Some broadcasting respondents have dual roles. For example, the BBC (as well as some other PSBs) has an interest in our proposals as both broadcaster and multiplex operator, and Arqiva carries out roles as both transmission provider and multiplex operator. For this reason, we have generally summarised the responses from broadcasters and multiplex operators together, except where there is an obvious opposing view. Readers should note, therefore, that it may not always be easy to identify which role is being represented by those stakeholders where a difference in view may exist dependent on its role as multiplex operator, broadcaster and/or transmission provider.

Question 2. Do you agree that the proposed DTT migration criteria are proportionate and appropriate? If not, please explain why and clearly identify any other criteria you believe should be adopted and why.

Summary of responses

4.6 There was strong support for the proposed DTT migration criteria from the vast majority of respondents including broadcasters, multiplex operators, telecoms providers, MNOs and equipment manufacturers. However, some broadcasting respondents suggested that further prioritisation and/or weighting of the DTT migration criteria was needed. Some PMSE respondents disagreed with the criteria on the basis that we were not providing similar protections for existing PMSE users of channels 61 and 62. We deal with PMSE issues in section 5.

4.7 Several broadcasters and multiplex operators also noted that there was a need to more clearly define the DTT migration criteria to provide further certainty about how subsequent decisions would be taken. It was also argued that two of the terms used in the criteria were ambiguous – those of costs being "reasonably incurred" and the DTT coverage solution being "consistent with existing policy objectives after DSO".

4.8 The BBC proposed separating the DTT migration criteria into decision, implementation and frequency planning criteria. It suggested that our DTT migration criteria should take account of the following:

- a clearly positive CBA;
- the ability to compensate effectively and adequately those suffering from the changes, including broadcasters, PMSE users and consumers;
- an effective and well-funded plan for supporting vulnerable consumers; and
- a detailed plan which ensured that DTT coverage would be the same as it would have been without the changes.

4.9 Once these criteria were met, the BBC proposed that a prioritisation order for the criteria should be considered for implementation, in the following order:

- to minimise impact on consumers – to ensure any cost they would have to bear would be fully compensated, any disruption they would face would be adequately mitigated and the interests of elderly and vulnerable viewers in particular would be fully assessed and planned for;
- that all costs related to the clearance could be paid by those benefiting from that clearance, and that the existing authorised and planned users of channels 61 and 62 should not bear extra costs whilst being able to offer their DTT services to the same number of households; and
- that the DSO process should not be disrupted, or that any disruption should be kept to a minimum and only occur when there are clear benefits.

4.10 Digital UK also thought further implementation criteria would be necessary. It noted it would need to update its DSO impact assessment to properly assess the impacts of the 800 MHz clearance on DSO, from which these criteria could be developed.

4.11 In addition, the BBC proposed the following principles for planning channel changes:

- coverage should stay the same as currently proposed for all six multiplexes as far as possible so consumers (and broadcasters) are not disadvantaged;

- where an impact on consumers' reception is unavoidable (i.e. the impact of an essential change has been limited to the smallest possible number of consumers), consumers should be compensated by providing a new aerial;

- broadcasters and other major stakeholders should be able to influence the timescale for channel changes, in order to minimise any impact on other significant transmission upgrade programmes (notably DSO and DVB-T2); and

- no costs should be borne by broadcasters, who should be compensated for any management, communication and other costs incurred.

Our assessment

4.12 We received considerable support for the DTT migration criteria as proposed. Most respondents agreed that they were proportionate and appropriate.

4.13 While we see merit in relation to some of the BBC's proposed criteria, we do not accept that all are relevant to our decision on whether to adopt the proposed DTT migration criteria. This is because some criteria have already been met (e.g. a positive CBA) and therefore are not relevant for further decisions, while others are more appropriate for implementation and spectrum planning (as the BBC itself notes), some of which require further analysis before decisions can be taken on them. We will, however, consider its suggestions as part of our plans for implementation, and we agree that we will need to think carefully about how we implement the DTT migration criteria throughout the implementation process.

4.14 Our ability to demonstrate how we will satisfy the DTT migration criteria is in large part led by key technical decisions that will be taken over the coming months as our new frequency plan for DTT is developed. Therefore while we are unable to provide an assessment now, we will work closely with affected stakeholders before taking final decisions based on these criteria. Where decisions are subsequently taken we will set out clearly our rationale, including an explanation of how we have taken account of the DTT migration criteria.

4.15 We have considered whether to further define the terms in the DTT migration criteria to provide stakeholders with more certainty about how they will be applied. We have concluded that, as constructed, the terms are appropriate and that they provide a necessary element of flexibility required at this stage. We do, however, discuss at paragraphs 4.96-4.106 below, our assessment of costs which we expect will be included. We provide clarification of our existing policy objectives for DTT coverage at paragraph 4.112.

4.16 With respect to the BBC's point about the need for a positive CBA, we establish in section 3 (with further detail outlined in the impact assessment in annex 2) there is a clear positive benefit to UK citizens and consumers in clearing the 800 MHz band.

4.17 We agree developing detailed, effective and well-funded plans that take account of the DTT migration criteria should be a priority. These should include support plans for vulnerable viewers. We can confirm that we would expect to involve broadcasters, multiplex operators and other affected stakeholders when developing the implementation timetable for these changes.

4.18 We noted earlier the Government's commitment to fund the costs of clearing the 800 MHz band, and we agree (as set out in our DTT migration criteria) that costs should not be borne by existing authorised and planned users of channels 61 and 62. We cannot yet comment on the BBC's proposals for compensation to be paid to affected viewers, broadcasters and multiplex operators as we cannot draw conclusions on the nature and scale of any impacts on these stakeholders until the technical plan is finalised. However, we do intend to work with affected stakeholders over the coming months to clarify these impacts and to establish how best to address each.

4.19 We also note the BBC's proposal that an objective of the clearance programme should be for the resulting coverage to stay the same as currently predicted for all six multiplexes, as far as possible. We agree that this is a sensible objective that will help minimise impacts on viewers, broadcasters and multiplex operators. While we consider that the DTT migration criteria already sufficiently address coverage matters, we have decided to adopt this as an objective for implementation and will include it in our instructions to the planners preparing the new frequency plan.

4.20 With regards to whether certain criteria should be prioritised at certain stages of the process, we believe there may indeed be merit in some prioritisation. We are, at this stage, reluctant to assign any priority order. We will therefore further consider this issue as we prepare our plans for implementation. This will be addressed by an internal steering group which we are establishing to oversee the clearance programme; we will discuss any proposals with stakeholders before adopting them. We consider the BBC's suggestion to prioritise the support needs of vulnerable viewers in more detail in paragraphs 4.129-4.130.

4.21 We understand that Digital UK would, as part of its programme management of DSO, update its impact assessment in light of our decision to clear DTT from channels 61 and 62. We will provide input to Digital UK as and when required.

Our decision

4.22 In light of the support provided in responses to the 800 MHz consultation, we have decided to adopt the DTT migration criteria proposed in our consultation. These are:

- there should not be a material adverse effect on DSO;
- existing authorised and planned users of channels 61 and 62 should not bear extra costs that must reasonably be incurred in order to clear the spectrum; and
- any solution should be consistent with existing policy objectives for DTT coverage after DSO, and the process should aim to minimise the impact on viewers of broadcasts from the existing DTT multiplexes.

4.23 We will consider all aspects of the implementation plans against the DTT migration criteria. As noted above, we will also include specific provisions about maintaining existing coverage as far as possible and involve stakeholders when taking decisions about the implementation timetable. Where we take decisions based on these criteria as we establish our implementation plans, we will explain how the criteria have been taken into account.

Spectrum reorganisation

Our proposals

4.24 We commissioned NGW (now Arqiva) to investigate the spectrum reorganisation options for accommodating the displaced DTT assignments in UHF Bands IV and V below channel 61. Its report identified three options, all of which proposed substituting channel 61 and 62 with channels 39 and 40. The report proposed that this substitution could occur in either one step (that is via direct substitution) or using two steps which would use intermediate channels in order to minimise the need for households to adjust or replace aerials (by ensuring frequencies within the existing aerial group for any given region are used). The third option was a hybrid approach which used the two-step option but with variations where required.

4.25 When assessed against the DTT migration criteria, we proposed that the hybrid option was, on balance, the strongest because it:

- results in the smallest number of remedial changes to household aerials, meaning few, if any, such aerials would need adjusting or replacing;
- minimises the number of changes to transmitter antennas (the most difficult changes); and
- should minimise potential DTT coverage losses across the UK.

4.26 Despite being the strongest option, we did note that the hybrid option would require a greater number of changes to the network infrastructure and therefore a higher number of household retunes. While retuning is an issue that requires careful consideration and management, it imposes a lower impact and cost on viewers than either aerial or coverage changes (both of which would be much higher under the other reorganisation options). In addition, we thought that the materiality of retuning impacts would reduce as viewers learn more about retuning through DSO.

4.27 We sought views on the spectrum reorganisation options as follows:

Question 3. Do you have views on the options identified and our assessment of them? Do you believe there are other, superior options, and, if so, why? Do you agree that the hybrid option is most consistent with the DTT migration criteria?

Summary of responses

4.28 Respondents across the board (including broadcasters, multiplex operators, equipment manufacturers, telecoms providers and MNOs) agreed with the options we set out and gave their support for the hybrid option as the best solution. They agreed that it was least disruptive for viewers and most consistent with the DTT migration criteria, given that it minimised the need for new aerials. Hutchinson 3G (H3G) supported the option which released the spectrum soonest. PMSE responses also agreed with the hybrid option as the best solution, but indicated a preference for allocating channels 39 and 40 for PMSE use.

4.29 However, despite strong support, the complexity of implementing the hybrid option was noted by several broadcasting stakeholders, given the network infrastructure changes it required. The BBC, for example, thought further detailed analysis would be required on all affected transmitters (including knock-on impacts) before taking a

decision and that the Joint Frequency Planning Project (JPP)[18] should decide between the two-step and hybrid options (though it did rule out the one-step process due to the consumer detriment involved in the number of households that would be required to change their aerials).

4.30 Arqiva further noted that a full analysis could not be undertaken until a final frequency plan has been agreed – which is heavily dependent on international negotiations. Orange also noted the importance of completing international negotiations as soon as possible, and requested that updates be given to relevant stakeholders about progress and status of agreements as they were reached.

4.31 Intellect queried whether up to 100,000 households may need new aerials under this approach anyway, and asked how we would be raising awareness of retuning with viewers to inform them about the changes. RNID also thought that we could play more of a role in encouraging viewers to undertake regular retuning exercises, particularly in working with vulnerable stakeholder groups. Furthermore, RNID thought there was a role for us in leading an equipment monitoring programme to identify functionality issues and a common terminology base for consumer equipment, and feeding this back to equipment manufacturers.

4.32 David Hall Systems queried why the coverage impacts of changes in neighbouring countries' spectrum plans were treated differently.

4.33 O2 did not think the 800 MHz consultation was sufficiently clear on the number of households using group E aerials or how the assessment took this into account.

Our assessment

4.34 We agree with stakeholders that the technical planning analysis and network infrastructure changes required to implement the hybrid option are complex and will take some time to fully assess. Our plans for implementation will set out our further thoughts on this and we provide an indicative timetable for completing this work in section 7. In particular, we expect to work closely with key affected stakeholders and existing planning groups to progress key spectrum planning work and note the need to consider additional interactions that may flow from any reassignments. We will publish progress updates so those interested can keep abreast of developments[19].

4.35 We do not underestimate the importance of quick decisions for this process and to this end have developed a draft frequency plan that will form the basis of international frequency negotiations. We are working toward agreeing a draft high level main transmitter plan by early 2010 (though we note that this is unlikely to be ratified until at least mid 2010). France intends to switch off her analogue frequencies in 2011 and has signalled that she will also clear the 800 MHz band. The common goals of the UK and France will help align our timing objectives. We also note that other countries have also signalled their intention to clear the 800 MHz band.

4.36 There are two leading hybrid reorganisation options using four possible intermediary channels: channels 48 and 51 (option A) and channels 49 and 50 (option B). We hope to come to an early view on which of these options we should adopt. We have commissioned Arqiva to evaluate the relevant technical infrastructure issues

[18] Resourced jointly by us, Arqiva and the BBC, JPP's Management Board also comprises a wider group of broadcasting stakeholders including Digital UK, broadcasters and multiplex operators.
[19] For details of how to register to receive free email updates about the publication of relevant Ofcom documents, see www.ofcom.org.uk/static/subscribe/select_list.htm.

alongside other technical analysis to help inform our approach to this decision. As this analysis is ongoing, we are not in a position to indicate in this statement which of the two hybrid options we intend to implement. We expect to be able to take a decision on the preferred option in July, and this will inform our plans for implementation. We aim to publish the results of the Arqiva study in the summer.

4.37 Although our preliminary assessment showed that the number of household aerials affected under the hybrid option is likely to be very low compared with the other options – an upper limit of 10,000[20] rather than several tens or hundreds of thousands – some aerial realignment or replacement remains likely. For example, it may be beneficial to replace a small number of aerials if this is most cost effective or helps avoid a much larger number of retunes. Nevertheless, the total number of changes would still only be a fraction of those likely for other reorganisation options.

4.38 We agree viewers' use of group E aerials would substantially reduce the impact of DTT clearance as they would allow channels to be moved in one step, simplifying the frequency transition plan and so the number of homes required to retune. However, while group E aerials could potentially partially mitigate the impacts of a large frequency shift, a very large number of household retunes would regardless still be necessary because of relatively low (and disparate) group E aerial adoption[21].

4.39 Clarification was requested as to why coverage impacts in neighbouring countries' spectrum plans were treated differently for each of the reorganisation options. This was simply down to having recently responded to normal bilateral requests from neighbouring countries so more up-to-date information was available for the hybrid option. We note any resulting coverage impacts would be fairly small and unlikely to make any significant difference to the figures quoted in the 800 MHz consultation.

4.40 Lastly, with respect to our playing a role in raising awareness of retuning and encouraging viewers to regularly retune their DTT receiving equipment, we agree that there may be certain steps we can take to facilitate and/or support industry in enhancing awareness of this issue. We understand that steps are already being taken in this area where key industry bodies – such as Digital UK, the Digital Television Group (DTG) and Freeview, in conjunction with broadcasters – are considering how best to provide advice to viewers about how to retune and the benefits of doing so. This work is also considering how this information can be provided to address the wide range of functionality included in new and existing DTT equipment[22]. The DTG's involvement will ensure that equipment manufacturers are kept informed of any decisions taken. We support this work and will speak with the relevant parties to ensure the clearance programme is coordinated with this broader viewer education initiative.

[20] The impact assessment in the 800 MHz consultation conservatively accounted for up to 100,000 aerial changes.
[21] Other than at two main stations – Bluebell Hill and Hannington, where households are known to use group E aerials – the number of households across the rest of the UK with group E aerials installed is not well documented and therefore reliance on them as a mitigating factor has not been assessed. Households in this latter group have taken individual decisions to install this type of aerial when upgrading an existing aerial and for a variety of reasons, such as to receive low power DTT services or analogue Five, to improve reception or in readiness for DSO.
[22] Digital UK's website already includes manufacturers' manuals to assist viewers with retuning – see www.digitaluk.co.uk/retuning.

Our decision

4.41 On the basis of widespread support and as set out in our impact assessment (see annex 2), we have decided to move DTT from channels 61 and 62 following the two-step hybrid reorganisation option, which minimises the need for aerial changes and thus reduces the overall impact on DTT viewers. It will though increase the number of households affected by retuning. This is an important area in which we need to carry out further work to assess what support would be required to make this process easier for viewers and how to minimise the impact especially on vulnerable viewers.

4.42 We discuss consumer issues in more detail at the end of this section together with our initial thoughts on managing this very important matter. We also set out how we propose to take work forward in this area.

4.43 We note that an important but subsidiary decision remains on which intermediate channels to use. We expect to take a decision on this in July, forming a key input for confirming our draft frequency plans and enabling us to continue international engagement on frequency coordination at pace.

Implementation timing options

Our proposals

4.44 Our proposals noted the importance of DTT clearance in relation to both the potential impact on the DSO programme and ultimately the availability of the cleared spectrum for new services.

4.45 We also set out the five key elements of the DSO implementation programme and why this clearance process would require careful management, especially if it was integrated into DSO. This is particularly important given that the DSO planning and procurement process has been underway for several years and is now well advanced. The 800 MHz consultation estimated, hypothetically, that planning for implementation in each DSO region (including sequential stages for spectrum planning and network infrastructure design and rollout, through to consumer communications and switchover) could take up to four years to implement.

4.46 Taking account of our objective that clearing DTT from channels 61 and 62 should not result in any material adverse effects on DSO, and bearing in mind the other DTT migration criteria, we identified three timing options for implementation:

- **recast DSO**. We said that while, at face value, incorporating the new spectrum plan within the DSO timetable has major benefits (including reduced cost and, in theory, less impact on viewers as fewer household retunes would be required), we believe that the preparation and rollout of DSO is now too far advanced for many of the theoretical benefits to be realised, and the delays this would now create would be highly disruptive for DSO;

- **post-DSO implementation** (i.e. retrofitting the changes once DSO has completed). We said that while this has some theoretical attractions (principally the very low risk to DSO), it is likely to unnecessarily increase the potential impact on viewers, increase implementation costs and impose higher spectrum opportunity costs as it delays the release of the spectrum for new uses; and

- **DSO integration**. We proposed that carefully integrating implementation with DSO provides the best opportunity to minimise costs, disruption to viewers and

any delay to the use of cleared spectrum while avoiding uncertainty and material adverse effects to DSO. We considered that this option achieves the benefits of recasting DSO, when assessed against the DTT migration criteria, at much less cost and risk.

4.47 We acknowledged that it would be necessary to weigh up the different policy objectives set by the DTT migration criteria, and that further analysis was required on a site-by-site basis before we could determine the extent to which DSO integration was possible. We noted that assessing the timing options would help establish broadly how to proceed, providing the basis for further analysis for implementation.

4.48 We sought stakeholders' views on the implementation timing options as follows:

Question 4. Do you have views on the implementation timing options identified and our assessment of them? Do you agree that DSO integrated implementation is most consistent with the DTT migration criteria? If not, why not?

Summary of responses

4.49 There was broad agreement with our proposed policy of integrating DTT clearance with DSO, on the proviso that DSO implementation is prioritised along with existing DTT programmes such as DVB-T2 rollout (from broadcasters and multiplex operators) or that the process is expedited in order to release spectrum as quickly as possible (from telecoms providers and MNOs). The BBC summarised the trade-offs involved in making a decision on timing as weighing up:

- the costs and benefits of early versus later implementation;
- the extent to which DSO integration would be considered more or less disruptive for viewers than retrofitting; and
- the time required to design and implement the solution.

4.50 Broadcasters and multiplex operators indicated that the scope for DSO integration would be limited to the later stages of DSO. This is due to planning now being well advanced, meaning in their view 2014 was a more realistic timeframe for completing clearance and therefore providing UK wide access to the 800 MHz band. Some of these respondents also questioned the true benefits of a DSO integrated approach with such limited scope as they felt it could increase the risk of a disruption to DSO.

4.51 Two broadcasters (BBC and Five), Digital UK and a multiplex operator indicated that post-DSO implementation would also be acceptable as it was the least complicated, although some respondents noted this was likely to be the most costly option and would lead to the most disruption to viewers. The BBC suggested that post-DSO implementation be considered as the base case with integration opportunities taken where possible. An argument was put forward by broadcasters and multiplex operators that post-DSO implementation is actually the most realistic option due to the practicalities and complexities of DTT clearance.

4.52 All broadcasters and multiplex operators as well as Digital UK agreed that recasting DSO was least preferred and most likely to endanger DSO objectives and dates for completing DSO. Only BECTU preferred this option because it thought this provided an opportunity to reconsider the scope for single-frequency networks (SFNs) and wider adoption of more efficient technical standards allowing more HD services to be carried on DTT.

4.53 A general view presented by broadcasting sector stakeholders was that the timeframe proposed for clearing the spectrum was optimistic, especially in light of international coordination, spectrum planning and design requirements. Stakeholders were concerned about resource availability in the short term (due to peak workloads on DSO) and also that important DSO and DVB-T2 work could be adversely affected as a result.

4.54 Conversely, telecoms providers and MNOs were concerned that the timescales for clearance were too conservative and lengthy in comparison with other European countries. For example, T-Mobile was concerned about the potential for delay of an integrated approach until 2014 (or later) and sought clarification on why it would take 4½ years to clear DTT, noting the costs of delay and potential loss of value this may have on the cleared award. In particular, it pointed to our 2G liberalisation analysis which (it stated) argues that a three month delay could cost around £45m.

4.55 Orange supported the option which provided greatest certainty of delivering earliest clearance, especially as we estimated there was only approximately six months' difference between the three options presented. Orange also indicated that mass market equipment for the 800 MHz band was unlikely to be available until 2013/14. H3G suggested that channels 61 and 62 were already unused by DTT in many geographical areas, with less than 200 sites involved in total, and so could potentially lead to earlier release. It favoured regional deployment and that priority be given to clearing channel 62 (if a choice between it and channel 61 was required) to maximise FDD pairs available for early deployment in the 800 MHz band. It also requested that no new deployment be permitted in these frequencies.

Our assessment

4.56 Timing remains a key variable in this process and we will need to take full account of this as part of the decision making process and when balancing the interests of existing/planned users (such as broadcasters and multiplex operators), and those who wish to make use of this spectrum. We note and agree with the trade-offs identified by the BBC as being central to this decision.

4.57 Generally, we consider that, provided the DTT migration criteria are met, the benefits of integrating sites or regions where possible cannot be ignored. Although there are cost advantages to integration, perhaps the most significant benefits of integration relate to avoided or reduced impacts on viewers and the potential for expediting spectrum release. While it is too early to conclude the extent to which clearance could be integrated with DSO, initial analysis undertaken for us by Arqiva indicates that integration should be possible in some later switching regions. We intend to publish the findings of this analysis in July as well as to progress technical work in this area, with a broader group of stakeholders, over the summer. We will take account of this work as well as a number of other inputs (e.g. spectrum planning, international negotiations and viewer impacts) when deciding whether integration is appropriate at a particular site.

4.58 If integration is not possible at a particular site, we agree with stakeholders that the next best solution is to retrofit the clearance plan once DSO completes in each region. However, we think it is preferable to also consider whether some regions can be retrofitted before DSO as a whole is completed. We would expect to discuss this matter further with affected stakeholders before deciding on the retrofit schedule. Given where we are at in the DSO process, we do not believe that recasting DSO is a credible option because the theoretical benefits are outweighed by the costs and risks to DSO and viewers and the delay to spectrum clearance.

4.59 We note the contrasting views presented by stakeholders on when it may be feasible to complete the clearance of channels 61 and 62. Most broadcasting stakeholders view our timeframe for clearance as optimistic, while potential new users of this spectrum considered that our timeframe for clearance was too conservative. There are obvious benefits from moving DTT from this spectrum as soon as technically and practically feasible, while meeting the DTT migration criteria, and we are committed to doing so.

4.60 We also note the important work we will be prioritising to ensure international coordination is achieved promptly, and we are working closely with Arqiva and the BBC to ensure additional planning resources are deployed to support this. However, we also noted in the 800 MHz consultation that the international coordination and spectrum planning components of DSO have up till now taken several years to complete. Our experience to date with DSO shows that as rollout of the network infrastructure design progresses, new interactions between frequencies are identified. These can have subsequent effects on the coverage of neighbouring relays, and we do not underestimate the complexity of network frequency planning and gaining the relevant international clearances required to complete this programme of work.

4.61 In response to T-Mobile's points about the costs of delaying the use of this spectrum, we agree that delays are potentially costly, and we have provided an estimated cost of a further 12 month delay for DTT clearance in the impact assessment at annex 2. We are working to bring about the release of spectrum from channels 61 and 62 as quickly and efficiently as possible, but given the scale of this task and taking account of the need to satisfy the DTT migration criteria, we also highlight the risks of moving too quickly (which also carry potential additional costs).

4.62 With regards to H3G's response on the low impact to sites, its assessment only takes account of the directly affected transmitters and relays using channels 61 and 62. However in adopting the hybrid reorganisation option, the transmitters and relays using the intermediary channels (at the first step), as well as those which go on to use channels 39 and 40, will also be affected, with additional knock-on impacts to neighbouring sites likely. Our preliminary analysis shows this is likely to affect considerably more than the 200 sites suggested. We will publish further information setting out the number and scale of sites affected as the technical analysis confirming this is completed. We will provide a high-level assessment as part of our plans for implementation later in the summer.

4.63 We note H3G's points about future deployment in these frequencies. We discuss our position on this in paragraphs 5.69 to 5.71 in section 5.

Our decision

4.64 As noted above, decisions on implementation timing will be a crucial part of implementing the clearance. Our initial analysis indicates that at least some integration with DSO will be possible and that the true extent of the opportunity for this will become clearer as we progress key work in the second half of this year. We conclude, in light of responses and because of the significant potential benefits of integrating with DSO, that this should be pursued wherever possible while abiding by the DTT migration criteria. We therefore consider that completing the clearance of channels 61 and 62 by the end of 2013 remains challenging but credible.

4.65 As noted above we anticipate a close dialogue with affected stakeholders over this period to help ensure that these crucial decisions are fully informed and contribute to

taking full account of all the relevant issues. We set out how we intend to take this work forward in section 7.

Programme control and governance

Our proposals

4.66 The 800 MHz consultation noted the need for robust programme management, control and governance arrangements which are clearly scoped, well designed, and appropriately resourced with clear lines of accountability and particular focus on budgetary accountability. We also noted the commonalities that the clearance programme would have with DSO, particularly the important role of providing advice and support to viewers.

4.67 We recognised the potential for conflicting objectives and, as a result, the importance of effective coordination (including with DSO), strong controls and aligning the incentives of principal parties.

4.68 We outlined an illustrative programme structure with governance and programme management functions overseeing a number of functional workstreams.

4.69 We sought views on the programme control and governance arrangements outlined as follows:

Question 5. Do you agree that a programme-control and -governance arrangement such as that outlined above is appropriate?

Summary of responses

4.70 Most respondents on this question (including Intellect, Ericsson, broadcasters, some multiplex operators and Arqiva) agreed that it was crucial to put clear lines of accountability in place to ensure the project's success and avoid the risk of delay. However, there was no clear view expressed as to whether the programme control and governance structure proposed was itself appropriate (although Orange did provide its support). Some broadcasters and multiplex operators thought that a DSO like structure would be appropriate given the close links to this work and scarce resources. There was general concern about the risk of overcomplicating the programme from some stakeholders (a multiplex operator, Channel 4 and T-Mobile), which might lead to delays. Orange specifically requested an MNO representative be on the programme board or for regular updates to be provided to those stakeholders.

4.71 Arqiva, Digital UK and some broadcasters and multiplex operators thought decisions on this aspect were premature with further work needing to be completed first, in particular decisions on the funding solution with clear commitments made. These parties also asked whether the funding organisation(s), once known, would have a role in the process to ensure value for money.

4.72 Digital UK argued that in order not to jeopardise DSO, it should manage all the network changes until DSO is completed in 2012, although alternative arrangements would have to be set up to continue the evolution of the DTT network after 2012. The BBC argued that key stakeholders (i.e. broadcasters and those affected by the proposals) should be able to influence the timing of any changes to the network so that impacts on other transmission programmes (such as DVB-T2) could be minimised. One multiplex operator emphasised that it should be able to retain control over the requirements for network resilience. The BBC suggested that JPP lead on

the practical aspects of this work (with stakeholders), with decisions taken by an steering group of major parties led by us. Some parties asked that we provide further clarity as to who Arqiva's client would be under the proposed arrangements.

4.73 Digital UK also indicated there was scope for conflict between the DSO and 800 MHz clearance programmes. David Hall Systems suggested the programme may need a built-in conflict resolution process for potential disagreements between parties.

Our assessment

4.74 The programme structure we outlined was illustrative only but helpful in focusing the minds of respondents on this important area. The generally positive responses suggest a structure akin to the one proposed (which is similar to that used for DSO) may be appropriate though considerably more work is required to confirm decision-making processes and to determine how best to deliver the functional workstreams. We agree that it is difficult to bed down these arrangements absent further clarity around funding and financial accountability, which was not possible to provide in the 800 MHz consultation. There is increasing clarity in this area now which, coupled with analysis undertaken during the consultation period[23] and consultation responses, means that we believe it will be possible to put in place the appropriate programme structure, governance and control arrangements over the summer.

4.75 We believe that one of the most important requirements of the programme governance arrangements will be enabling robust decision making where there are potentially opposing views. This will require accurate information and the objective application of the DTT migration criteria. Although we have not settled on the programme structure, governance and control arrangements we will establish in early July an internal steering group for overseeing implementation, the first task of which will be taking important decisions about the programme management arrangements discussed above. Those decisions will be informed by the consultation and analysis undertaken during the consultation period. We set out in section 7 our proposed next steps in this area.

4.76 With regards to network planning, we agree that there is a key role for JPP to lead on spectrum planning in the initial programme stages, given the correlation with frequency planning work it already undertakes. We also believe that close cooperation with and the support of Digital UK's Broadcast Infrastructure Group (BIG) will be essential. Working with these two existing industry groups will help ensure that DTT clearance planning work is undertaken as quickly as possible and is consistent with DSO. We set out these plans in further detail in section 7.

4.77 Arqiva plays several important roles as a multiplex operator, the transmission network operator, a key member of JPP and an adviser to us on spectrum planning and transmission network matters. Arqiva also has broader interests as a potential user or service provider for future users of the 800 MHz band. We also note the very complex contractual arrangements already in place, both for transmission provision and to deliver the DSO programme, between Arqiva, broadcasters and multiplex operators. We agree that there will need to be careful consideration of how to manage Arqiva's different roles in the implementation programme and we will consider whether it is necessary to extend existing working arrangements (Chinese walls etc.) or vary these to manage potential conflicts of interest.

[23] We commissioned Deloitte to undertake a study further considering how the programme might operate alongside and after DSO, and the governance arrangements that should be put in place.

4.78 With regards to a dispute resolution process, we note that existing procedures would be expected to operate in some instances (e.g. between multiplex operators and Arqiva, where the Adjudicator for Broadcast Transmission Services has a role in managing contractual disputes between the parties).. However, as we already successfully do on other broadcasting infrastructure projects, we expect to work collaboratively with key stakeholders as our plans for implementation develop, and would hope to continue our existing good relationships with these parties.

Our decision

4.79 Having carefully considered respondents' views, we confirm robust and transparent programme management and governance processes are essential for ensuring the success of the clearance programme and for ensuring effective use of public money.

4.80 We will take decisions on the programme structure, governance and control arrangements over the summer when we have greater clarity on key factors affecting this (such as funding arrangements) and when ongoing analysis is completed.

4.81 We have established an internal steering group, which will meet for the first time in July, to take key decisions relating to the clearance programme including the appropriate governance, management and controls. The study undertaken during the consultation period by Deloitte, together with the views of respondents, will inform our thinking. Ensuring the appropriate level of input by stakeholders will be a key factor in the design of these arrangements. We are looking closely at where potential synergies with existing arrangements might be achievable, and are now discussing how to take this work forward through JPP with Arqiva and the BBC, and with Digital UK. This is discussed in more detail in section 7.

4.82 We will also review our Code of Practice on Changes to Existing Transmission and Reception Arrangements[24] in light of our decision to clear the 800 MHz band, having particular regard to where network resilience responsibilities will fall throughout implementation. We intend to work closely with existing operators and will consider the need for transitional arrangements as we have done during DSO.

Implementation cost categories and profiles

4.83 In the 800 MHz consultation, we asked two questions about the types of implementation costs involved in clearing channels 61 and 62, and when these would likely be incurred during the programme. Given the overlap in responses we received from stakeholders, we address both questions together below.

Our proposals

4.84 We proposed that the costs involved in clearing channels 61 and 62 were likely to be significant (though not on the same scale as for DSO), would be incurred between 2009 and 2013, and fell into four broad cost types:

- **spectrum planning**. We expected the bulk of these costs to fall in 2009 and 2010 as spectrum plans for main and relay stations are developed, though costs will continue to be incurred at a reduced level throughout 2011, 2012 and 2013;

- **infrastructure reengineering**. We expected these costs would begin to be incurred from 2010, when initial works orders are placed, and would continue

[24] www.ofcom.org.uk/tv/ifi/tech/codes_guidance/cop/cop.pdf.

through to a peak in 2012/13, when we anticipated that the bulk of the network engineering works will be undertaken;

- **communications and support**. We expected a relatively low level of activity in the initial years, consisting largely of planning and coordination with DSO-related communications to the extent appropriate, with communications and support activities ramping up in 2012 and 2013; and

- **programme management**. We expected these costs would begin to be incurred almost immediately, when the programme management and governance structures will be established and planning undertaken, continuing through to managing network changes and communications in 2012 and 2013.

4.85 Based on this work profile, we anticipated that the bulk of the costs would begin to be incurred in 2010, peaking in 2012 and 2013. Costs in 2009 were likely to focus on spectrum planning and setting up the programme.

4.86 We also set out a preliminary illustrative cost estimate for implementing the hybrid option of £85-185m (NPV)[25]. This range includes non-cash costs of approximately £15m for the up to 11 million households that would need to retune their DTT receivers. The cost range reflected the range of possible scenarios from one where minimal infrastructure changes and consumer communications were required, to a worst case scenario which reflects large scale and complex works and more intensive communications and support activities.

4.87 We sought views on the cost categories and spend profile as follows:

Question 6. Do you agree that the four cost categories adequately capture the costs associated with clearing DTT from channels 61 and 62? Are there any costs that do not appear to have been accounted for in any of these categories?

Question 7. Do you agree that our cost profile is a reasonable basis for planning the capital expenditure for clearing DTT from channels 61 and 62?

Summary of responses

4.88 In general there was broad agreement on the four cost categories and relative shape of the cost profiles by telecoms providers/MNOs and those with a broadcasting interest, although the latter group thought the profile would be extended into 2014 for infrastructure reengineering and communications works as they thought it unlikely that the programme could complete in 2013.

4.89 Further, broadcasting respondents did not believe we can provide any certainty on cost profiles until spectrum planning is completed, and thought there may well be ongoing operational costs over and above DSO. They considered that it was important to first establish the baseline DSO costs before trying to establish what the additional costs of this programme will be and that this will need to include current contractual arrangements for DSO delivery between broadcasters, multiplex operators and Arqiva. They thought costs were likely to be at the high end of estimates provided, and may require some cashflow flexibility to deal with the likely

[25] This illustrative estimate is based on one particular scenario, the hybrid spectrum-reorganisation option with DSO integration. While we consider this estimate appropriate for the purpose of the cost-benefit analysis set out in this document, it has not been independently scrutinised and was not supported by formal estimates.

uncertainty across the life of the programme. The BBC considered that cost profiles for the programme would also depend on the availability of resources from Arqiva and a funding solution being put in place.

4.90 Broadcasters and several multiplex operators suggested that funding should cover an additional category for broadcaster compensation, which includes management time, impact on services during retuning, loss of viewer confidence in DTT and loss of DTT coverage area.

4.91 S4C, the BBC and Digital UK noted that there will be a need for a support programme for viewers (like the current DSHS) after DSO which will lead to associated support costs, though they did mention that the DSHS would be in place for a short while after DSO in each region.

4.92 Ericsson and Intellect suggested the cost range was very wide which could increase the potential for it to be wrong. They also called for further qualification before decisions were taken. Both noted cost uncertainty would make bidding for spectrum in the 800 MHz band difficult – especially if this clearance was to be licensee funded.

4.93 T-Mobile thought the retuning costs were too high especially in the context set out in the 800 MHz consultation that retuning is a standard task, regularly undertaken and lasts for just a few minutes per TV set.

4.94 Virgin Media identified a further cost of modifying their customer premises equipment (and potentially other network elements) for cable TV viewers and Internet users, and wished to be compensated for this. Virgin Media also suggested that interference from two-way mobile communications may impact on DTT reception and that additional costs may be incurred to mitigate any interference problem.

4.95 An individual respondent raised the need for communal aerials (such as those in flats) to be retuned and/or replaced by professionals, which would be an additional cost for landlords if it occurred after DSO.

Our assessment

4.96 The four broad cost categories identified in the 800 MHz consultation were generally supported by stakeholders, notwithstanding that further work is required to define all the individual costs within each category. We intend to discuss these categories further with affected stakeholders. In addition to the direct costs of clearance, some responses referred to potential indirect impacts (e.g. potential losses arising from marginal changes in coverage or competitive effects on the DTT platform). We discuss these potential indirect impacts further towards the end of this section.

4.97 We agree that these changes will also mean that some communal aerial systems – in multiple dwelling units such as student halls, flats and care homes – may require retuning. We believe that many communal aerial systems either will not require any attention or can be retuned without professional assistance. However, we are aware that some (i.e. those that are channelised) will need to be professionally adjusted. This could potentially affect up to 50% of the systems, although our preliminary analysis suggests that this figure is likely to much lower at around 20% of systems. While we still need to undertake further analysis to quantify these impacts and are working with Digital UK to better understand this issue, we have included an estimated additional cost in our CBA and impact assessment.

4.98 As we have concluded with regards to retuning costs for households in general, we assume that viewers and operators of communal equipment will undertake any retuning themselves, this being a normal and necessary feature of the DTT platform. We would though expect that they would be provided with appropriate help and advice to assist them in carrying out this task. We note that the support programme we will put in place is considering how best to address retuning for vulnerable groups, and we will include this as part of that consideration.

4.99 As set out earlier, the Government has committed to meet the costs of clearing the 800 MHz band. This provides the required certainty to take forward our plans for implementation with relevant stakeholders. We have not seen evidence which indicates that the cost range is likely to fall outside the range estimated in the 800 MHz consultation. We note, however, that significant uncertainty remains and that both the absolute cost and spend profile of the clearance programme will not be confirmed for some time because both are dependent on a number of as yet uncertain factors. For example both the overall cost and spend profile will be affected by the extent to which the clearance can be integrated with DSO, which is influenced by ongoing international negotiations and logistical constraints. Even when the implementation plan is confirmed it will still be necessary to distinguish between DSO baseline costs and incremental clearance costs. We expect to be able to further refine costs as our plans for implementation, in particular the technical frequency plans, are confirmed.

4.100 We are taking steps to ensure adequate resources are in place to respond to the demands of this work programme. For example, we are holding discussions with relevant spectrum planning stakeholders and JPP about the need to bring in new resources to deal with this work so that it can be expedited without adverse impact on the DSO programme.

4.101 We agree that based on DSO experience to date, some viewers (particularly vulnerable groups) will find retuning difficult and may need a further level of support. We have included provision for this within the communications and support category. We believe, however, that the nature of the impacts on viewers is yet to be confirmed and we are taking a number of steps to avoid or mitigate these impacts wherever possible. We do not agree that our cost estimates for retuning are overstated. They were non-cash costs based on households' retuning equipment within 15 minutes, which our experience shows the majority of viewers are able to achieve.

4.102 Our view on retuning is informed by consultation responses, ongoing dialogue with key stakeholders and research we have commissioned relating to consumer communications and support issues[26]. We draw no conclusions at this stage about the extent, if any, to which the DSHS should be involved, though we expect to address this as part of our preparations for implementation. We discuss retuning and consumer communications and support issues further toward the end of this section.

4.103 We have now further refined our analysis of the number of households that will need to retune DTT equipment (in part to take account of non-DTT viewing households). The 800 MHz consultation estimated up to 11 million households would need to retune. We now estimate the theoretical upper limit for retuning to be 13 million as we have included a further 2 million business premises. When accounting for non-DTT

[26] We commissioned a study during the consultation period from a consortium consisting of Fishburn Hedges, AMV and Mediacom to investigate the scale and significance of consumer issues and how these might be managed and mitigated through appropriate communications and support requirements, particularly for vulnerable groups.

viewers[27], this is reduced to an upper limit of 10.5 million households/premises. However, we believe that with careful detailed planning it should be possible to halve the number of premises that will need to retune equipment. We will continue to work closely with Arqiva and the multiplex operators during implementation to ensure we can reduce retuning impacts for viewers as far as possible.

4.104 Virgin Media's concern about impacts on their cable customers is relevant to DSO and the DDR more widely, and is not brought about by our proposals to clear the 800 MHz band alone. Its concerns have already been discussed further in section 3 .

Our decision

4.105 We conclude that the four broad cost categories set out in the 800 MHz consultation are appropriate. We note that further work is required to capture all the individual costs within each category and intend to discuss this with affected stakeholders.

4.106 We do not believe that it is possible to define the absolute cost and the spend profile of the clearance programme at this stage. We will continue to refine our cost estimates as decisions around implementation are taken and further information comes to light over coming months. For planning purposes, we will retain the broad cost range estimated in the 800 MHz consultation: £70-170m (NPV), excluding the non-cash retuning costs of £15m. We have seen no evidence which indicates the costs would fall outside this range. When including the retuning costs and impacts for communal aerials (which we provide estimates for in paragraph A2.63 of the impact assessment in annex 2), this cost range is estimated to be £100-220m (NPV).

Other issues raised by stakeholders

4.107 Some respondents raised a number of further consumer and platform issues in their responses on which we did not specifically consult. These issues relate to how the changes might best be communicated to affected viewers and how/when this should tie in with DSO communications, viewer support requirements (including the role, if any, of the DSHS), and how viewer and consumer impacts of these changes (such as retuning, aerial changes and DTT coverage changes) could best be managed.

4.108 We agree that these are important considerations and established earlier in this section that minimising impacts for viewers and coverage is a key objective for this process. We have grouped comments into four main themes in making our assessment below: DTT coverage, retuning, consumer communications and support, and DTT platform effects.

DTT coverage

Summary of responses

4.109 Broadcasters and multiplex operators raised concerns about impacts to DTT multiplex coverage[28], including that the three commercial multiplexes might be disproportionately affected under our proposals such that each would be left with differing levels of coverage. It was suggested that detailed analysis on the scale of

[27] We conservatively estimate all DTT viewing homes to be approximately 80% based on our latest digital television progress report, which shows 70% of homes currently watch DTT on at least one television set, with just over 10% of homes still watching analogue and yet to convert.
[28] Our initial planning assessment showed a slight increase of 0.01% for PSB multiplexes and a slight drop of 0.29% for commercial multiplexes.

this issue should be undertaken. There was further concern that we appeared to be minded not to protect planned coverage of the commercial multiplexes.

4.110 Considering the issue from a consumer perspective, Channel 4 thought that it would be unlikely that any coverage impacts could be delineated simply as affecting either PSB or commercial multiplexes, and viewers may lose one, two or even more multiplexes as a result of the changes. Five noted that some consumers, who would have gained coverage through DSO, may now lose it because of the 800 MHz clearance. It was also noted that such differential coverage from the commercial multiplexes was inconsistent with existing policy objectives.

4.111 In response to any coverage impacts that may result, both the BBC and Five wanted us to investigate options to boost coverage. The BBC suggested additional relay sites may be needed to restore lost coverage, especially in southeast England.

Our assessment

4.112 We have made a series of policy decisions about DTT coverage after DSO:[29]

- for PSB multiplexes – these three multiplexes are required to match analogue core coverage across the UK (at least 98.5% of UK households); and

- for commercial multiplexes – no specific coverage obligations as the commercial operators are free to make their own decisions about their coverage. They were though required to operate from all of their existing (80) sites and ensure that their coverage does not fall below pre-DSO levels of 73%. The multiplex operators were also offered (and accepted) higher powers at these 80 sites which are predicted to result in them covering around 90% of UK households at DSO.

4.113 We established in paragraph 4.19 that an objective of the clearance programme will be to minimise coverage impacts wherever possible. We also propose to ensure that no single multiplex is disproportionately disadvantaged as a result of coverage changes. It is worth noting that we do not expect there to be significant coverage variations due to the clearance. We believe that this approach is consistent with our existing policy on DTT coverage objectives and what existing multiplex operators may reasonably expect from the current arrangements.

4.114 We agree with respondents that further detailed analysis is required to fully understand the potential impact of the clearance process on coverage. We expect to do this over the next 6-12 months as our frequency plans are finalised and will set out our approach for doing this in our plans for implementation. We will consider as part of this work options to boost coverage should any significant loss arise.

Our views

4.115 As a key objective, we will seek to ensure coverage impacts are minimised. Our current assessment of impacts remains consistent with existing policy objectives but we agree that further detailed analysis is required to fully understand the potential impact of the clearance process on coverage. We expect this analysis to be completed over the next 6-12 months as frequency plans are finalised.

[29] Statement on Planning Options for Digital Switchover, 1 June 2005, See www.ofcom.org.uk/consult/condocs/pods1/main/statement/statement.pdf.

Retuning

Summary of responses

4.116 Some broadcasters and multiplex operators predicted that the impact of retuning on viewers was likely to be more severe than forecast (on the basis of recent Selkirk and Rowridge examples). They thought that the DTT clearance programme was therefore likely to require more complex communications and support needs than initially proposed, particularly in light of current viewer unpreparedness and the wide varieties in consumer equipment on the market.

4.117 Five and Digital UK noted however that lessons from these experiences together with increasing viewer awareness through DSO will assist in better informing and supporting viewers in their preparations for retune events. T-Mobile thought (in light of the experience that households will gain experience from DSO) that we were overestimating the impacts of retuning.

4.118 The BBC also noted the benefits that new receivers with auto-retuning capability (being introduced later this year through the DSHS and also available to purchase for new HD services on DTT) will bring, although they suggest that these implementation costs should be covered by this programme.

Our assessment

4.119 While we are keen to minimise impacts on viewers and acknowledge that a retuning exercise on this scale is a complex task, we believe that our assessment of retuning impacts is reasonable and appropriate, even in light of the recent retuning examples at Rowridge and Selkirk. We have considered in detail the results of those exercises and while they provide useful information to help inform communications and support functions, some key differences exist between them and the retuning exercise necessitated by the clearance programme. For clearance, the changes will either be included in the DSO programme itself (so viewers will not be aware of the additional change) or it will occur in a region that has already completed DSO, where the majority of viewers will have had experience of retuning and we believe will, for the most part, have gained a degree of familiarity with the retuning process.

4.120 We also believe the situation at Rowridge was an exception in that it occurred outside and years in advance of the scheduled DSO programme (to accommodate French spectrum plans and switchover in the Westcountry region) and was also undertaken at relatively short notice. We commissioned some research with Digital UK around viewers' experiences of the Rowridge retune to help our understanding of retuning and to help refine the information and advice provided as DSO progresses. We will take account of this evidence in our decisions about the level of support that will be appropriate throughout the clearance programme.

4.121 Central to mitigating the effects of such a large scale retuning exercise for viewers will be how the communications and support are managed during implementation, in particular for vulnerable groups. We discuss this further in considering consumer communications and support below.

4.122 We are aware of the wide range of consumer equipment on the market and the differences in terminology employed by different manufacturers. This can create additional consumer confusion around retuning, particularly for older viewers and those less comfortable with technology. For instance, some equipment requires that viewers delete all their stored channels to complete the retune. This can imply for

many they will no longer be able to watch their current TV services. We understand Digital UK and broadcasters are working closely with the DTG and manufacturers to provide information for consumers on how to retune in simple terms covering a range of equipment as a way to address these concerns. We also agree the introduction of auto-retuning mechanisms[30] in new equipment, particularly in equipment provided through the DSHS, will help to mitigate these impacts significantly.

Our views

4.123 The scale of retuning required by the hybrid reorganisation option is significant and we have concluded that it will need careful planning. However, we think that the task will be manageable in light of viewers' experience with DSO provided vulnerable groups are given appropriate support (which we intend to ensure). Minimising the requirement to retune and communicating effectively where retunes are required, coupled with support for vulnerable viewers, are central to successful clearance and will be reflected in our plans for implementation.

Consumer communications and support

Summary of responses

4.124 Digital UK made a number of suggestions for how we might manage consumer communications and support. Its experience suggests that the following activities will need to be planned for:

- above the line communications (e.g. advertising the need to retune);
- viewer support functions including a website and contact centre (noting that contact centre support will be a significant cost element);
- practical outreach support on the ground for those needing face to face retuning advice (and aerial modification/replacement if required). This may include extending the DSHS (subject to the Government and the BBC agreeing);
- trade communications costs, particularly to electrical retailers and aerial installers, who will need to be made aware of the changes;
- communications to the housing sector including landlords whose communal aerial systems will need to be re-channelised; and
- media handling, stakeholder management and public affairs.

4.125 Other stakeholders also suggested the DSHS (or a version of it) may have a role to play in this process, particularly given its ongoing support role after DSO.

4.126 Digital UK noted that the proximity to and potential overlap of this clearance with DSO may have implications for the messaging and/or credibility of DSO. Generally, it thought it was too early to decide whether or not to link the two communications processes, and that a view should be taken by the governance body and Digital UK at a later date.

[30] The auto-retune function performs a full equipment retune as and when required without the need for manual intervention from householders, and thereby removes the consumer confusion and disruption element from the retuning process.

4.127 Five wanted to ensure that consumer communications clarified any resulting loss of coverage for viewers was not due to a decision by broadcasters. Where differential coverage of commercial multiplexes resulted, some broadcasters noted that this would be a complicated message to deliver to consumers.

4.128 To address support requirements, Arqiva and the BBC suggest that we consider providing an aerial installation and/or replacement service. It was also suggested that the programme could undertake (and fund) a door to door retuning exercise (such as that undertaken by Five for its service rollout during 1997).

Our assessment

4.129 We do not underestimate the challenge some viewers will face as a result of our decision to clear channels 61 and 62 and therefore communications and support feature as a key workstream for implementation. As noted above, we commissioned a study from a consortium led by Fishburn Hedges specifically to look into these issues. The preliminary results from this study are consistent with the suggestions made by Digital UK above and will inform our plans for implementation.

4.130 We also draw attention to the need to take specific action to understand and address the needs of vulnerable groups including but not limited to those covered by the DSHS. We are still considering the appropriate level of support that will be needed and will take account of suggestions from respondents for addressing support needs. We think practical experience and knowledge gained from DSO and research commissioned (including jointly with Digital UK) will be invaluable to this assessment.

4.131 In respect of an ongoing role for the DSHS, we note that at a minimum it will still be in operation in DSO integrated or later switching regions and therefore will play some role in our plans for implementation (though assistance is time bound under the existing terms of the scheme[31]). Any extension of the scheme is a decision to be taken by the Government in conjunction with the BBC who manage the process.

4.132 We note Digital UK's concerns that carrying out this programme of work while DSO is under way may impact on the credibility of the DSO programme and agree this will need to be taken account of in any consumer communications. We agree that decisions on managing this impact should be taken, in consultation with Digital UK, once there is greater clarity on how the clearance programme will be implemented.

4.133 In any case and regardless of whether the programmes are integrated, consumer communications must be coordinated with DSO as we think this will help reduce consumer confusion. We note Five's concerns that the reason for the changes – to introduce new services in the 800 MHz band – be incorporated in the messaging and agree this request should be considered when preparing consumer communications.

Our views

4.134 We are fully aware of the need to communicate clearly with viewers and to provide support to vulnerable viewers where required. We will take particular account of these issues in our plans for implementation. It is not yet clear what level of support will be required and how the changes should best be communicated to consumers, as both will be influenced by the manner in which the clearance is implemented. However, a study we have commissioned to examine the scale and significance of

[31] For eligible viewers who apply and are accepted into the scheme, assistance is available for up to 12 months after DSO completes.

the issues will inform our views in this area and we highlight the need for our plans for implementation to consider the level of support vulnerable groups may require.

4.135 We intend to set out plans for addressing communications and support, taking account of consultation responses and our own analysis and research, as part of our plans for implementation later in the summer. We agree that in preparing these plans we will need to work closely with Digital UK, the DSHS and other stakeholders.

DTT platform effects

Summary of responses

4.136 Some broadcasters and multiplex operators thought the combined effect of these changes – the coverage and retuning issues identified above – may negatively impact on the DTT platform, making it seem less attractive because of retuning disruptions, loss of coverage and potentially increased cost and thereby reducing DTT's competitiveness. Some also noted that the new pattern of cleared spectrum would offer less opportunity for DTT growth through additional multiplexes.

4.137 There was concern that, in aggregate, these changes could weaken the platform and erode the commercial value of investments by broadcasters and multiplex operators.

Our assessment

4.138 We have considered the views put forward by some broadcasters and multiplex operators regarding the potential for the changes to negatively impact the DTT platform. While there may be some disruption for DTT viewers, we believe that the level of disruption for each household will be relatively minor, leading in the most part to viewers spending a small amount of time retuning their equipment. We discussed in paragraph 4.40 our understanding that the industry is considering how to educate viewers to consider retuning as a routine, periodic activity that will help ensure any service changes are picked up. We believe that this is a sensible initiative which we would support as a matter of good practice for the platform. We also note that this notion of periodic "refreshment" is not distinct to the DTT platform. For example Sky subscribers undergo a periodic replacement programme for their conditional access systems every few years, and Freesat viewers are regularly asked to rescan their equipment to update their programme list.

4.139 Although viewers switch platforms for a number of reasons we consider on balance DTT viewers will consider the retunes resulting from the clearance programme to be a minor disruption that would be highly unlikely to lead to a decision to switch platforms. For the same reasons, we do not consider there is a credible argument that the clearance programme will have any tangible effect on the competitiveness of the platform. We note our latest Digital TV update which indicates the success of DTT in the UK. Viewer numbers continue to grow and it has been the UK's most popular television platform choice for the past two years. We have already explained above why we think coverage changes other than those at the margins are unlikely.

4.140 With regards to constraining opportunities for DTT growth, we set out in section 3 that with careful planning we still believe sufficient spectrum will be available in the 600 MHz band to enable two further DTT multiplexes to be launched with reach of up to 90% of the UK population, though this is obviously dependent upon any successful bidders for this spectrum deciding to use it for DTT services. In combination with technological advances launching on DTT shortly, which will in the longer term

unlock the potential for substantial growth in existing capacity on the platform, we are not persuaded as to the merits of this argument.

Our views

4.141 It is unclear to us from the arguments put forward by stakeholders that DTT would suffer as a platform as a result of the clearance programme. Well managed communications and support activities together with the broader initiative to promote periodic retuning will substantially reduce the impact of retuning on viewers.

Conclusions

4.142 This section summarised the responses we received from stakeholders to our proposals for moving DTT from channels 61 and 62, and set out our assessment and decisions in light of these responses and further analysis we have completed.

4.143 In summary, we have decided to:

- adopt the DTT migration criteria which provide that –
  - there should not be a material adverse effect on DSO;
  - existing authorised and planned users of channels 61 and 62 should not bear extra costs that must reasonably be incurred to clear the spectrum; and
  - the solution should be consistent with the existing policy objectives for DTT coverage after DSO and the impact on existing DTT viewers should be minimised;
- adopt the two-step hybrid option for accommodating DTT in alternative spectrum to channels 61 and 62;
- integrate the DTT clearance programme with DSO to the extent possible, while abiding by the DTT migration criteria; and
- establish programme management and governance arrangements this summer.

4.144 We concluded that the four broad cost categories and cost profile set out in the 800 MHz consultation are appropriate and will continue to refine our cost estimates as we develop our plans for implementation over the coming months.

4.145 We set out our plans for implementation, including important milestones for decision making and spectrum planning and how we will engage with relevant stakeholders during this process, in section 7.

Section 5

Moving PMSE

Introduction

5.1 The 800 MHz consultation set out a number of proposals to clear channel 69 of its current use, PMSE, whilst minimising any disruption that this move would cause the sector. We were sensitive in making these proposals that we found the most appropriate solution for PMSE users, who we acknowledge place great importance on their access to channel 69. As such, we proposed to find replacement spectrum which closely mirrored those characteristics of channel 69 which make it so attractive to PMSE users. We also proposed that licensees who faced the disruption of having to replace or modify their channel 69 equipment should benefit from funding arrangements to assist them with the move to replacement spectrum.

5.2 In our consultation on future spectrum access for PMSE, published on 20 June 2007,[32] we set out four key objectives:

- avoiding disruption to PMSE users that adversely affects their ability to provide a wide range of services to citizens, consumers and business customers;
- facilitating participation of the PMSE sector in a market-based approach to spectrum;
- promoting the optimal use of spectrum in relation to all potential uses and users over time; and
- avoiding the risks of regulatory and market failure.

5.3 We considered in the 800 MHz consultation that making channel 69 unavailable for PMSE use and offering no viable replacement or funding would cause unacceptable disruption.

5.4 This section sets out our conclusions on the replacement spectrum for channel 69 in light of responses to the 800 MHz consultation. It also gives further details on the arrangements which will be put in place for access to this replacement spectrum. We then outline the next steps for developing funding arrangements for eligible PMSE users, including decisions on the eligibility criteria for groups of users and our thinking on aspects where further consideration is necessary. This will be subject to further consultation in the near future.

Our criteria for assessing possible alternatives to channel 69

5.5 In the 800 MHz consultation, we set out three criteria against which we assessed possible alternatives to channel 69 for PMSE use. These criteria were:

- **technical**. Could the spectrum be used without interference by wireless microphones? How many microphones could use it? Would microphones interfere with other users?

[32] www.ofcom.org.uk/consult/condocs/pmse/pmse.pdf.

- **coverage**. Could the spectrum be used by wireless microphones across the UK? How close would it be to other spectrum usable by microphones? and

- **economic**. What other uses of the spectrum would be displaced by wireless microphones? How valuable would they be to citizens and consumers? What would the likely costs for PMSE users be?

5.6 We asked the following question on these criteria to assess whether we were using the best approach:

Question 8. Do you agree that these are the most appropriate criteria to assess which spectrum is the best alternative to channel 69 for PMSE?

Summary of responses

5.7 Responses were broadly in favour of the criteria that we used although some PMSE users suggested that we should also take into account other factors of importance to them. For example, the British Entertainment Industry Radio Group (BEIRG) and others[33] argued that any replacement spectrum should be adjacent to interleaved spectrum to mirror channel 69's adjacency to channels 67 and 68. Moreover, these respondents pointed to terrestrial television's relatively sparse occupancy of these channels which leads to their being extensively available throughout the UK.

5.8 A number of PMSE users also stated that another critical criterion is whether identical licensing arrangements to those currently applied to channel 69 would remain, particularly so called "shared licences" whereby a set number of frequencies are available for licensed use without the need for frequency coordination.

5.9 There were also a number of responses that stated that we should consider withholding awarding another two 8 MHz channels of cleared spectrum adjacent to channel 38 until we have sufficient certainty that PMSE users will have adequate spectrum to meet existing and future demand.

Our response

5.10 We do not consider that adjacency to interleaved spectrum is a necessary criterion for the replacement for channel 69 as this would not be a feature of channel 69 in the base case (i.e. after DSO and the clearance of channels 63-68). However, as outlined in the 800 MHz consultation, we do accept that there is significant benefit for some PMSE users in being able to tune wireless microphones across more than one channel. This is because it can facilitate the use of more than eight microphones where there is a higher demand for spectrum.

5.11 We also agree that any replacement spectrum for channel 69 should be subject to licensing arrangements comparable to those currently in place. This is addressed in more detail below, in paragraphs 5.81-5.83.

5.12 In terms of the request that we should hold back cleared spectrum for PMSE use, we note that the certainty we need to award the 600 MHz band and the certainty PMSE users want about the availability of interleaved spectrum will both be delivered by the outcome of negotiations with neighbouring countries. As a result, we do not think it is necessary to take a position on this now but will instead keep it under review.

[33] A number of PMSE users endorsed BEIRG's response in its entirety.

5.13 Nonetheless, we have engaged with BEIRG on this particular issue when it was previously raised as a matter of concern. As noted in the 800 MHz consultation, we published a statement on 16 January 2008 setting out our best estimate at that time of available interleaved spectrum for PMSE use post-DSO.[34] This suggested availability was expected to increase after DSO in most locations of high PMSE demand but there were a limited number of locations where it would be problematically low. Nonetheless, we stated that this assessment was likely to be conservative and understate the actual quantity of available interleaved spectrum.

5.14 We are now refining this assessment in light of the DTT-protection approach proposed in the geographic-interleaved consultation document published on 12 June 2008[35] and confirmed for the first awards, covering the Manchester and Cardiff areas, in the statement we published on 29 October 2008.[36] We expect to publish a further statement with our refined assessment in the near future.

Our technical and coverage assessment of possible alternatives

5.15 In the 800 MHz consultation we set out our assessment of the six leading candidates that had been identified as possible replacements for channel 69. Those candidates were as follows:

- interleaved spectrum only;
- channel 38;
- FDD duplex split;
- channel 70 (862-870 MHz);
- 872-876/917-921 MHz; and
- 1785-1800 MHz.

5.16 Each of these options had been identified as fulfilling one or more of the key criteria (outlined in paragraph 5.5 above) that would make it suitable replacement spectrum for PMSE use of channel 69. As a result we assessed these options against those criteria to see which would be the most suitable replacement spectrum.

5.17 Our initial assessment looked at technical and coverage criteria only, because we considered that any option which did not sufficiently fulfil these criteria would not be proposed as replacement spectrum for PMSE use of channel 69 regardless of how well it scored on the economic criterion. This assessment concluded that only two options were suitable: interleaved spectrum only and channel 38.

5.18 We asked for comments on this analysis in the following question:

Question 9. Do you agree with our technical and coverage analysis of the possible alternatives to channel 69 for PMSE?

[34] www.ofcom.org.uk/consult/condocs/ddr/statement/statement2/statement.pdf.
[35] www.ofcom.org.uk/consult/condocs/ddrinterleaved/interleaved.pdf.
[36] www.ofcom.org.uk/consult/condocs/notice524/.

Summary of responses

5.19 Most responses to this question broadly agreed with our assessment although BEIRG, JFMG (which currently grants wireless telegraphy licences to PMSE users on our behalf) and the Spectrum for Programme Makers Forum (representing a number of professional wireless camera users and manufacturers) stated that they did not consider interleaved spectrum to be a sufficiently promising replacement for channel 69 based on our technical and coverage criteria alone.

5.20 A number of respondents stated that they considered that the FDD duplex split could be considered a viable replacement for channel 69 based on these two criteria even though its existence depended on a particular outcome of a service and technology neutral award.

5.21 There was also concern that there may be interference into channel 38 from the new services that are deployed in channel 37. For example, the Royal National Theatre suggested that a guard band should be established at the top end of channel 37 to protect wireless microphones in channel 38 should that prove necessary.

Our response

5.22 We accept that, at present, interleaved spectrum has some significant drawbacks from a coverage perspective. A standard 24 MHz tuning range for a wireless microphone would not facilitate UK wide spectrum coverage based on our current understanding of the likely configuration of interleaved spectrum after DSO. However, we do not preclude the possibility that devices with wider tuning ranges could be successfully deployed in the future which would enable UK-wide coverage. We also note that interleaved spectrum scores strongly against our technical criteria as it is proven to allow the deployment of eight microphones per channel with little risk of harmful interference from adjacent DTT use.

5.23 We remain of the view that the FDD duplex split remains a sufficiently uncertain proposition for now to lead us to conclude that it is not a viable alternative to channel 69 for PMSE. Even if it were, it remains inferior to channel 38 because of its isolation from interleaved spectrum that would enable more than eight microphones in the same tuning range to be successfully deployed.

5.24 The concerns over whether channel 38 may be subject to interference from services in channel 37 led us to make a further assessment of the impact of those likely alternative services. This work shows that of all these services, the one which would potentially cause most disruption into PMSE would be DTT. However, this represents the same arrangement as at present with channel 69's adjacency to channel 68. It also reflects the established sharing arrangements in the interleaved spectrum between PMSE and terrestrial television. We know this to work well in practice.

5.25 As a result of this further assessment, we can say with increased confidence that channel 38 will offer the facility for PMSE users to deploy eight wireless microphones in a single channel on an interference free basis.

Our economic assessment of possible alternatives

5.26 Our further assessment of the two leading options to replace channel 69 looked at the value of the spectrum based on its opportunity cost. This figure was derived from the highest value placed on the spectrum by alternative users who were being denied

access to it because of PMSE use. This analysis stated that the likely value of the three options was as follows:

- interleaved spectrum only – £1.6m (based on an alternative use of low-power mobile business radio); and
- channel 38 – £122k (based on an alternative use of DTT in Wales and Northern Ireland).

5.27 We asked for comments on this analysis with the following question:

Question 10. Do you agree with our economic assessment of the realistic alternatives to channel 69 for PMSE?

Summary of responses

5.28 Some PMSE respondents were concerned that the methodology used to derive the opportunity cost of spectrum did not take into account broader value to society created by PMSE users. Some stated that a purely market-based approach to estimating the value of spectrum was not appropriate in this instance because of the special circumstances of PMSE, which was an established use of this spectrum but not necessarily in a position to pay market rates.

5.29 Other stakeholders, such as BEIRG and the Royal National Theatre, stated that any estimate of the value of spectrum should take into account the costs that are involved with having to move from one part of the spectrum to another. These responses referred, in particular, to the costs of modifying or replacing existing equipment.

5.30 The Spectrum for Programme Makers Forum noted that the opportunity cost of channel 38 was dependent on its continuing use for radioastronomy in the Netherlands. It asked for further clarity on whether the estimated value of £122k would change should Dutch radioastronomy cease.

Our response

5.31 Our approach to valuing spectrum has been developed over a period of time and focuses on the benefits that are foregone from assigning spectrum to one user instead of another. We consider that this gives us the most accurate estimate of the economic value of spectrum. We believe the opportunity cost figures that we proposed in the 800 MHz consultation (and subsequently refined – to zero over the period 2010-13 in the case of interleaved spectrum – in our second band manager consultation document) indicate that PMSE users would be able to pay to access either interleaved spectrum or channel 38 without suffering disruption.

5.32 In terms of our wider approach of ensuring that spectrum fees for PMSE do not cause disruption, we set out a number of proposals in our second band manager consultation that address this particular issue. These proposals are designed to ensure that any future increases in fees for spectrum access by PMSE users will not unreasonably disrupt their ability to continue providing a service to citizens, consumers and business customers. We have invited comments on those proposals.

5.33 We address the costs that PMSE users will incur if they need to move from channel 69 in our decisions on funding later in this section.

5.34 Comments over the future opportunity cost of channel 38 being dependent on continuing Dutch radioastronomy use were addressed in the 800 MHz consultation. We stated that if the Netherlands cleared radioastronomy from this spectrum, the restrictions on its use in the UK would likely be relaxed.[37] If this happened, there could be more alternative uses (e.g. a DTT multiplex with UK-wide coverage using an SFN), with a potentially higher value. We would in general expect to reflect this in the licence fee charged to the band manager and thus in the fees that it charges its customers in the longer term. However we also noted that we are not aware of any plans for radioastronomy to stop using channel 38 in the Netherlands. This remains the case.

Our assessment that channel 38 is the best alternative to channel 69 for PMSE

5.35 Our assessment that channel 38 was the best alternative to channel 69 rested on three factors, namely:

- it is the closest alternative in technical terms, both in its own right and in terms of adjacency to interleaved spectrum;
- it is already available and used for PMSE; and
- it has a relatively low opportunity cost – and, as a result, price for PMSE users – for the foreseeable future.

5.36 We asked for comments on this assessment in the following question:

Question 11. Do you agree that channel 38 is the best alternative to channel 69 for PMSE?

Summary of responses

5.37 On balance, responses to this question indicated that channel 38 was the best of the six options based on the assessment outlined in the 800 MHz consultation. However, there were a number of concerns amongst stakeholders.

5.38 Two respondents disagreed with our wider proposal to move PMSE from channel 69, although they did not comment on our analysis of the costs and benefits of clearing the 800 MHz band.

5.39 A number of respondents stated that although they agreed that channel 38 was the best of the six options, they also considered that there should be guarantees of contiguous interleaved channels for PMSE use. BEIRG argued that channel 38 should precisely mirror the current arrangement with channels 67-69, where channels 67 and 68 are relatively lightly used by terrestrial television and so offer near UK wide coverage. BEIRG proposed that a further two 8 MHz channels of cleared spectrum should be set aside for exclusive PMSE use.

5.40 Others, including the Institute of Broadcast Sound (IBS) and the Royal National Theatre, agreed that channel 38 was the best option although they expressed concern over the potential for interference from services in channel 37. They proposed that a guard band should, therefore, be established at the top end of channel 37. Wigwam Acoustics argued that we should consider removing channel 37

[37] Continued radioastronomy use in Belgium, France and Germany would still need to be protected.

from any future award process to ensure that channel 38 was kept free of harmful interference to PMSE.

5.41 Intellect stated that while it agreed with the reasoning set out in our assessment of the six leading options, it was not convinced by the need for a dedicated UK-wide channel for PMSE. It argued that further analysis should be carried out to determine actual levels of PMSE demand as it considered that there could be scope for clearing more channels for alternative use if supply of spectrum exceeded PMSE demand.

Our response

5.42 Although we recognise some stakeholders' reluctance to move from channel 69, we believe our assessment of the costs and benefits of clearing the 800 MHz band clearly shows that this proposal is in the wider interests of UK citizens and consumers. As a result, we remain persuaded that, subject to ensuring that authorised PMSE users are found a suitable replacement and provided with appropriate funding, we should clear channel 69 of PMSE use.

5.43 We do not agree that our assessment of the best alternative spectrum to channel 69 should necessarily be widened to identify similar spectrum to the current arrangements in channels 67-69. This would not be a feature of the base case (i.e. after DSO and the clearance of channels 63-68). However, where we can provide replacement spectrum close or adjacent to interleaved spectrum, then we recognise the additional benefits that this would give to some wireless microphone users. In the event, channel 38 will be adjacent to interleaved spectrum in channels 39 and 40 (and above). We will be able to provide further information of the extent of DTT use of these channels when we conclude negotiations with neighbouring countries. In the meantime, we consider that channel 38 is sufficiently similar to channel 69 based on our key criteria, as well as its adjacency to interleaved spectrum, to be deemed a strong candidate to replace channel 69 for PMSE.

5.44 As stated in paragraph 5.24, our recent technical work on the potential for harmful interference from services in channel 37 into PMSE use of channel 38 shows that there is no greater risk than is currently the case for channel 68 into channel 69. Therefore, we do not propose to establish a guard band between channel 37 and channel 38.

5.45 We believe the argument that some PMSE users require a UK-wide channel of spectrum that facilitates the deployment of eight wireless microphones is a persuasive one. Although we note Intellect's suggestion that interleaved spectrum only could potentially fulfil the spectrum demand of PMSE users, for the reasons set out in paragraph 5.22 above, we do not believe that the current tuning characteristics of wireless microphones make this a viable proposition in the near term.

5.46 In terms of the suggestion that more spectrum could be released for alternative use, our intention, as set out in the second band manager consultation, is that the band manager will have an incentive to promote efficient use of spectrum for PMSE. One of the consequences of this may be the ability to release spectrum currently used by PMSE for use by alternative services which place a higher value on the spectrum. Separately, our revised statement on available interleaved spectrum for PMSE use, which we will be publishing shortly, will address this issue in some depth.

We proposed to award channel 38 to the band manager on the same terms as would have applied to channel 69

5.47 Our analysis of the six options against the key criteria which made channel 69 so valuable to PMSE users indicated that channel 38 was the leading candidate to be proposed as the replacement spectrum. We therefore proposed that, should we award channel 38 to the band manager, it would be on the same basis as would otherwise have applied to channel 69.

5.48 In coming to this proposal we stated that we were particularly mindful of the need for early certainty so that PMSE users could plan their future equipment purchases. We therefore proposed to award channel 38 to the band manager for an indefinite term subject to revocation after a period of notice given by us. We invited comments with the following question:

Question 12. Do you agree that we should award channel 38 to the band manager on the same terms as would have applied to channel 69?

Summary of responses

5.49 With the exception of the relatively small number of respondents who objected in principle to moving from channel 69 and one respondent who questioned the need for a dedicated and exclusive PMSE channel, reaction to this proposal was favourable. However, this was with certain caveats relating to continuing concerns amongst PMSE users.

5.50 As noted in paragraph 5.8, there was a particular concern that licensing arrangements should be the same as with channel 69. JFMG pointed out that we had been silent on this matter in the 800 MHz consultation and would need to be more explicit when making our decision. JFMG further stated that we should extend the proposed protection period for PMSE use of channel 38 beyond the 2018 date which had been proposed in our first consultation document on the detailed design of the band manager award, published on 31 July 2008,[38] because the period of moving to channel 38 would see replacement equipment being purchased as late as 2012.

5.51 The Professional Light and Sound Association (PLASA) agreed with this proposal, although it also stated that a key part of this decision should involve our precluding the use of cognitive devices in channel 38.

5.52 The Royal National Theatre agreed with our proposal, whilst arguing that the technical licensing conditions (TLCs) for this spectrum should be consulted on before a final decision is made.

Our decision

5.53 We have decided to award channel 38 to the band manager on the same terms as would otherwise have applied to channel 69.

5.54 We accept the argument that the licensing arrangements should be comparable to those currently in place for channel 69. Details of this are set out below, in paragraphs 5.81-5.83.

[38] www.ofcom.org.uk/consult/condocs/bandmngr/condoc.pdf.

5.55 We note JFMG's argument that the protection period for PMSE use of channel 38 should be extended beyond 2018 because of the date when replacement equipment will be bought to use this channel. This subject has been raised by others in the PMSE sector in response to the first band manager consultation. We will address it in full when we publish a statement on the band manager award later this year following the second consultation.

5.56 Our proposals for cognitive devices only envisage their use of interleaved spectrum,[39] so there is no read-across to PMSE use of channel 38.

5.57 We agree the TLCs for channel 38 should be consulted on before the band manager award. We are currently doing so in our second band manager consultation.

Timing for clearing PMSE from the 800 MHz band

5.58 One of the key concerns of PMSE users which impacts on our work across the digital dividend is for an orderly adjustment to the new configuration of spectrum available after DSO has occurred UK-wide in late 2012. PMSE users point to the following advantages for this of continued use of the cleared spectrum during this time as:

- it would allow sufficient time for an orderly migration from spectrum that will be awarded for new uses; and
- it would ensure a sufficient stock of suitable equipment for use for the London 2012 Olympic Games and Paralympic Games.

5.59 Our original approach was for the cleared spectrum to be made available for new use as DSO was completed region by region, subject only to those rights having been awarded. Initially we stated that this should be subject to there being a notice period of six months for PMSE users. We then sought views in the cleared award consultation as to whether this should be extended to 12 months.

5.60 Reponses from likely bidders in the cleared award suggested that they would not roll out new services in the cleared spectrum until it was available across the UK. The one possible exception to this was channel 36, which has now been cleared of use by aeronautical radar and so is available for new use across the UK from the point of its award.

5.61 As a result, we revised our proposals for PMSE use of the cleared spectrum and asked the following question:

Question 13. Do you agree with our proposal to maintain PMSE access to channel 36 on 12 months' notice to cease and to the rest of the cleared spectrum (channels 31-35, 37 and 61-69) until DSO is completed in the UK in late 2012?

5.62 Based on previous conversations with PMSE stakeholders, we also proposed to allow three years for an orderly migration from channel 69 to channel 38. This would involve establishing a funding mechanism by the end of 2009 so that this migration period would finish by late 2012, in line with the end of DSO. We sought comments on this proposal by asking the following question:

Question 15. Do you agree that three years is long enough for PMSE to move from channel 69?

[39] www.ofcom.org.uk/consult/condocs/cognitive/cognitive.pdf.

Summary of responses

PMSE access to cleared spectrum

5.63 Responses from PMSE users were in favour of our proposals. Many cited the time needed for the entire sector to re-equip itself with new wireless microphones. JFMG stated that it did not agree with the proposal to have a different approach to channel 36. It argued that there were current PMSE users of spectrum in this channel who would need sufficient time to make new arrangements.

5.64 Although some MNOs supported these proposals, we also received arguments from H3G and T-Mobile that we should revert to clearing PMSE with DSO on a regional basis. H3G, in particular, pointed to the potential to roll out mobile broadband in channels 63-68 and stated that this would be prevented if we were to allow continued PMSE access to the whole of the 800 MHz band.

5.65 Others, including BT, said that continued access to the cleared spectrum should be down to commercial negotiations between the new licensees and the band manager.

Timescales for migration

5.66 Most respondents agreed that our proposed timescales were reasonable. BEIRG and PLASA argued that the three years should start no earlier than the point the availability of channel 38 replicated that of channel 69. Other respondents signalled that the duration should begin at the point where funding is available.

5.67 There was concern expressed over the ability of UK wireless manufacturers to fulfil large numbers of orders, and a small number of respondents stated that they considered that more time may be needed. JFMG argued that there was a need to avoid vast numbers of users placing orders at the same time, causing logistical issues for manufacturers.

5.68 BEIRG stated that it was important for channel 69 to remain available throughout the migration period.

Our decisions

5.69 PMSE users face significant changes adjusting to the removal of their access to the cleared spectrum as well as the need to move from channel 69, notwithstanding the benefits afforded by channel 38 as its replacement. We do not underestimate the challenge, for which reason one of our key objectives for future PMSE spectrum access is avoiding disruption to their ability to provide services to citizens, consumers and business customers.

5.70 We equally accept that there may be benefits to early use of the 800 MHz band by new services. (No respondent argued to start new services in the 600 MHz band before the end of DSO.) However, we believe that these benefits are subject to considerable uncertainty:

- allowing 18-24 months for network build and testing from the likely date we could award the 800 MHz band, it appears unlikely that new services could be launched commercially nationwide much before mid-2012;

- by mid-2012, DSO will still not have taken place in Meridian, Tyne Tees and Ulster, and our draft spectrum plan for the London 2012 Olympic Games and Paralympic Games proposes using the cleared spectrum for that purpose until September 2012;[40] and

- even where DSO has taken place, the ability to use the 800 MHz band will be constrained by its continued use for terrestrial television in those parts of the UK where DSO has not taken place.

5.71 Where costs and disruption are certain and benefits are at best uncertain, we need to be particularly conscious of the risks of regulatory failure as a result of our actions (i.e. that their cost unexpectedly outweighs their benefits). Avoiding such risks is another of our objectives for future PMSE spectrum access, as outlined in paragraph 5.2. At the same time, the potential for and likelihood of early use of the 800 MHz band by new services may become significantly clearer in the near future as a result of the work the Government will expedite to resolve the key questions raised by the ISB's report for Digital Britain. We have therefore decided as follows:

- we will maintain PMSE access to channel 36 on 12 months' notice to cease. The prospects of new use of this channel ahead of the rest of the cleared spectrum suggest to us a continued need for different treatment of its temporary availability for PMSE;

- we will maintain PMSE access to the rest of the 600 MHz band (channels 31-35 and 37) until DSO is completed in the UK in late 2012. New licensees' rights to use that spectrum will only begin at that point;

- we will maintain PMSE access to the 800 MHz band (including channel 69) until at least the date when protection for UK radioastronomy use of channel 38 ceases, currently scheduled for 1 January 2012. This will be some two years after we hope to establish a funding mechanism and two and a half years after channel 38 is confirmed as the replacement for channel 69, during which time both channels will be available for PMSE use on comparable terms outside the protection zones for UK radioastronomy.

  We recognise these timescales fall short of the three-year period we proposed and still believe to be reasonable – if challenging – for an orderly migration from channel 69 to channel 38, whether counted from the availability of funding or from channel 38's availability as a comparable alternative to channel 69 for many PMSE users. This is particularly significant as we estimate that 95% of all wireless microphones in the UK are designed to tune to channel 69.[41] As a result, a large volume of new equipment will be needed to move to channel 38.

  Depending on the outcome of the Government-expedited work referred to above, it may yet be possible for PMSE access to the 800 MHz band to continue beyond 1 January 2012, up to the completion of DSO in late 2012 – three years after establishing a funding mechanism and three and a half years after confirming channel 38 as the replacement for channel 69. If not, we and the Government will need to consider how best to provide for an orderly migration.

[40] www.ofcom.org.uk/consult/condocs/london2012/london2012.pdf.
[41] Sagentia estimated in its report of 13 December 2006 on the use of UHF spectrum for PMSE in the UK that 95% of new wireless microphones sold and 50% of professional users' equipment are for use in channel 69. See www.ofcom.org.uk/consult/condocs/ddr/reports/report_sagentia.pdf.

The Government's timetable for this aspect of Digital Britain suggests there should be clarity on the duration of PMSE access to the 800 MHz band (including channel 69) in September 2009. New licensees' rights to use the spectrum will begin at the point PMSE access ends; and

- wherever and for as long as channels 61 and 62 have yet to be cleared of DTT, we will seek to facilitate continued PMSE access so long as this is consistent not only with DTT use but also new licensees' rights to use the spectrum on an interleaved basis.

Further details on how channel 38 will be made available for PMSE use

5.72 As outlined above, we have also been made aware that there is some need among PMSE users for clarity on what basis channel 38 will be made available to them. A number of concerns have been raised that the terms of access may not be set up in a way that makes channel 38 a genuine replacement for channel 69.

5.73 We have decided that channel 38 will be made available for PMSE use on the same terms as would have applied to channel 69. This means, in practice, the following:

- as at present, PMSE users will be able to obtain licences to operate equipment in channel 38 from JFMG. This arrangement will continue until the band manager begins operating; and

- channel 38 will then be available to the band manager, who will have to allow PMSE access on fair, reasonable and non-discriminatory terms until 2018 (as proposed in our first band manager consultation).

5.74 We are now in a position to outline the specific terms of PMSE access to channel 38. We have taken into account stakeholders' concerns about whether it is sufficiently comparable to channel 69 to be considered a replacement and seek to clarify issues of availability, licensing arrangements, refunds and high powered use.

Channel 38 will be available on a UK-wide basis from 1 January 2012

5.75 Channel 38 is available now for PMSE use, but with restrictions to protect the primary user of the spectrum, UK radioastronomy. These restrictions presently involve a 95km protection zone around Jodrell Bank in Cheshire and a 45km exclusion around Cambridge. In the 800 MHz consultation we explained that the protection for UK radioastronomy would end in 2012 and that channel 38 would be available on a UK-wide basis thereafter.

5.76 Responses to the consultation suggested that this timescale would create problems for those PMSE users who need to use their wireless microphones on a geographical basis. This was particularly the case because the current protection zones mean that channel 38 cannot be used in major urban areas such as Manchester and Liverpool (where demand for PMSE services is likely to be significant).

5.77 PMSE users stated that they would be faced with significant difficulties in planning for tours or performances before 2012 where the demand for their services was in the affected areas, particularly in the northwest of England.

5.78 As a result of these concerns we explored with the former Department for Innovation, Universities and Skills (now part of the Department for Business, Innovation and Skills) and UK radioastronomers whether there was any scope for the protection of

UK radioastronomy to be relaxed, either by reducing the protection zones or by bringing forward the date that protection ceases. These discussions resulted in the following agreement:

- the protection zones for radioastronomy should be reduced to the minimum necessary in light of up-to-date technical analysis; and

- UK radioastronomers will consider the scope for sharing channel 38 with wireless microphone users within the protection zones before their protected access ends on 1 January 2012.

5.79 We will publish a map showing the revised protection zones for UK radioastronomy shortly after the publication of this statement, at which point they will come into effect.

5.80 Outside the protection zones for UK radioastronomy, PMSE use of channel 38 will still be constrained in some areas by analogue terrestrial television in channels 37 and/or 39. These restrictions will end as DSO occurs in each region. We will publish the extent of these restrictions in further a series of maps which will show the number of available frequencies in each region and they how will increase as DSO progresses. These will be published at the same time as the maps showing the revised protection zones for UK radioastronomy.

We will replicate the channel 69 shared licensing arrangements in channel 38

5.81 A number of responses to the 800 MHz consultation stated that a key factor in the importance of channel 69 to PMSE users is the availability of shared licences. These licences enable PMSE users to enjoy freedom from interference from non-PMSE users (although with a slight increase in the risk of interference from other PMSE users) without having the increased transactional costs in coordinating frequencies every time they need to use that spectrum. A set of predefined frequencies on the licence determine which spectrum can be used.

5.82 In the 800 MHz consultation we did not address the licensing arrangements that would be put in place for channel 38. Having reflected on the representations made to us, we consider that, in principle, the shared licensing arrangements for channel 69 should be replicated for channel 38. To that end, we have asked JFMG to identify a set of frequencies for a channel 38 shared licence that will serve this purpose.

5.83 We will consult on the precise details of this shared licensing arrangement shortly.

Refunds for channel 69 licensees

5.84 We expect that a number of channel 69 licences held by PMSE users will not have expired by the time those users come to buy replacement channel 38 licences. We do not want to penalise these users by requiring them to pay for two licences valid at the same time and will put in place appropriate measures to address this.

High powered use

5.85 There is a small amount of use in channel 69 of equipment that operates at a higher power level than a standard 10 mW (handheld) wireless microphone. We have been asked whether this use can continue in channel 38, bearing in mind the protections for UK radioastronomy until 1 January 2012 and Dutch (and other international) radioastronomy in the longer term.

5.86 This higher powered equipment operates at a range of power levels from 50 mW to 5W. We note that current power restrictions mean that use of PMSE equipment at the higher of these levels is not currently UK-wide because of the risk of harmful interference to terrestrial television in channel 68. Accordingly, assignments for these devices are largely on a site specific basis.

5.87 This equipment also differs from 10 mW wireless microphones in that the raised power levels prevent the deployment of eight devices in a channel.

5.88 Our assessment of the protection needed for both UK and Dutch radioastronomy from higher powered wireless microphones shows that their use of channel 38 will carry geographical restrictions. We will set out the extent of these in a further series of maps alongside those mentioned above. However, because of the site specific nature of many of these assignments at these higher power levels, we consider that these PMSE users will also have the choice of replacing their channel 69 equipment with suitable interleaved spectrum.

5.89 Details of available interleaved spectrum will be made available after we have concluded the renegotiation of GE06 with neighbouring countries (see section 6). At that time, those affected PMSE users will be in a better position to decide which frequencies can act as a replacement for their use of channel 69.

Funding

5.90 The 800 MHz consultation set out our proposed approach to funding for those licensees who will have to modify or replace equipment as a result of moving from channel 69. We confirm in this statement that we have decided that funding will be made available for PMSE users who fulfil a number of set criteria as outlined below.

5.91 We do not address here what mechanism will be put in place to make payments to eligible users. This is an issue of some complexity, given the nature of the task, to which we are giving further consideration. Instead, we set out below the following:

- those parties who will definitely be eligible for funding;
- those parties who will definitely not be eligible for funding; and
- groups of users who may be eligible for funding but about whom we need more information before reaching a final decision.

5.92 We will consult on the funding eligibility of members of these last groups shortly after the publication of this statement.

Our assessment of eligibility

5.93 We set out in the 800 MHz consultation our initial assessment of which users and which equipment should be eligible for funding and the basis for calculating that funding. The four criteria that we proposed were as follows:

- equipment had to be purchased before the publication of the 800 MHz consultation;
- claimants had to have held a licence to use channel 69 valid before publication of the 800 MHz consultation;

- the equipment had to be capable of tuning to channel 69 but not channel 38; and
- the full lifecycle of that equipment from the date of its original purchase was 10 years.

5.94 We then set out our assessment of the likely level of funding taking into account the proposed criteria for eligibility and our understanding of the size of the UK market for channel 69 wireless microphones. That assessment suggested that the level of funding required to move wireless microphones from channel 69 to channel 38 would plausibly be in the range of £5-18m.

5.95 Our further consideration of the eligibility criteria that we will adopt for funding PMSE users' move from channel 69 (see below) suggests that there are likely to be significantly more licensees who qualify for financial assistance. We have therefore increased our estimate of the level of funding required to move PMSE from channel 69 to £15-£30m.

5.96 Having set out our approach to eligibility and likely scale of funding, we invited views by asking the following question:

Question 14. Do you agree with our approach to determining eligibility for, and our assessment of the level of, funding to move PMSE from channel 69?

Summary of responses

5.97 There was significant disagreement from PMSE stakeholders across three of the four eligibility criteria, although all respondents welcomed the general principle that funding would be made available.

5.98 Several respondents also disagreed with our proposed approach to calculating funding, which we would base on the unexpired lifecycle of the equipment (i.e. its residual value).

Equipment purchased before 2 February 2009

5.99 A number of respondents stated that this was an unfair prerequisite for funding. IBS argued that many community users would not have been aware of the changes and as a result may have bought channel 69 equipment after the cut off date. Others, such as the Association of Motion Picture Sound (AMPS) claimed that as there was no certainty over what the replacement spectrum would be for channel 69, some PMSE users may have had no choice but to continue buying channel 69 equipment. AMPS therefore proposed that the cut off point should be changed from the publication of the 800 MHz consultation to the announcement of what the replacement spectrum would be.

5.100 One confidential respondent suggested that the cut off date should be the point at which replacement spectrum becomes UK-wide. (In the case of channel 38, this would equate to 1 January 2012.) The respondent argued that this was because some users would have to continue buying channel 69 equipment where they continued to need UK-wide availability.

Holding a valid channel 69 licence before 2 February 2009

5.101 There was widespread disagreement with this criterion for several reasons. For example, some respondents such as BEIRG stated that all users of channel 69

equipment should be compensated irrespective of whether they had held a licence. It further argued that funding should be broadened to include all equipment that used currently interleaved spectrum but will have to be modified or replaced as a consequence of DSO and the DDR.

5.102 AMPS pointed out that some freelancers who had previously owned a licence but had allowed it to lapse because they did not need to use their equipment for a period would be unfairly penalised by this criterion.

5.103 There was also concern amongst some respondents that we had not taken into account hiring and rental companies that own equipment but have legitimate reasons for not holding a licence as they do not actually use the equipment themselves.

5.104 One respondent stated that we had overlooked licensees using channels 61 and channel 62 who may have bought equipment based on the understanding that they would be available for longer term PMSE use. This expectation was reversed in the same way as with channel 69.

Equipment tuneable to channel 69 but not channel 38

5.105 There was no substantive disagreement with this criterion.

10-year equipment lifecycle

5.106 Most respondents disagreed strongly with this assumption. Broadly speaking, this disagreement took two forms:

- those who argued that equipment will typically last for longer than this; and
- those who argued that the lifecycle of equipment will vary depending on the *type* of use (e.g. community users will derive a longer period of use from a wireless microphone than professional users because they use it less frequently and in less demanding environments).

5.107 Some respondents argued some equipment could last up to 20 years or more and our proposals as they stood would see PMSE users being denied the use of viable equipment with no prospect of any funding when they became effectively obsolete.

Assessment of level of funding

5.108 There was limited comment on the accuracy of our assessment of the total funding required to move PMSE from channel 69 to channel 38. However, those who did comment, such as Wigwam Acoustics and Audio Technica, suggested that we had underestimated the true figure and that the higher end of our range (£18m) was itself a conservative estimate.

Funding based on residual value of equipment

5.109 Several respondents stated that funding should account for the full modification or replacement costs of equipment. Disagreement with this proposal was also closely linked to respondents disputing our 10 year assumption for the lifecycle of wireless microphones.

Our decisions

5.110 We accept that a number of the representations from stakeholders have significant merit and agree that groups of PMSE users beyond those recognised in our proposals may be considered eligible for funding.

Users who will be eligible for funding

5.111 We have decided that the following should definitely be eligible for funding:

- PMSE users who fulfil all the criteria set out in the 800 MHz consultation; and
- rental companies who own, but do not operate, PMSE equipment that otherwise fulfils the criteria in the 800 MHz consultation. These businesses will have to show to our satisfaction that their operations are based on equipment hire as opposed to equipment use.

Users who may be eligible for funding subject to further consultation

5.112 We have further decided that there may be some users in the following categories who should be eligible for funding:

- users who held channel 69 licences before 2 February 2009 but who had legitimate reasons for allowing those licences to lapse for a period prior to the 800 MHz consultation;
- users who needed to purchase channel 69 equipment between 2 February 2009 and the publication of this statement for demonstrable and compelling reasons; and
- users who need to purchase channel 69 equipment between the publication of this statement and 1 January 2012 (when channel 38 becomes available for PMSE use UK-wide) because their existing equipment is demonstrably in need of replacement and channel 38 equipment will demonstrably fail to meet compelling operational requirements.

5.113 We will need to consider further what reasonable additional criteria for funding eligibility should apply for users in these groups. For example, we will need to decide the acceptable duration for a user not to have held a channel 69 licence before the 800 MHz consultation. We will also need to determine what would constitute a compelling reason to purchase channel 69 equipment after that date.

5.114 We have carefully considered responses calling for funding to be available to PMSE users of channels 61 and 62. Our decision that this spectrum would be removed from PMSE use was set out in our December 2007 statement on awarding the digital dividend, providing at least four years' notice (and possibly up to five if PMSE access to the 800 MHz band can continue beyond 1 January 2012 up to the completion of DSO in late 2012). Consistent with our approach to funding for PMSE users affected by the clearance of VHF Band III Sub-Band 3 (when three years' notice was given), we believe this period to be more than sufficient to allow licensees to make alternative arrangements. We are therefore minded to conclude that they will not be eligible for funding as a consequence of our decision to clear the 800 MHz band. However, we will consider representations from PMSE users who feel that there are special circumstances that in their view may entitle them to a different period of notice.

5.115 Similarly, we regard PMSE users of cleared spectrum (i.e. channels 31-37 and 63-68) as having received more than sufficient notice of the need to clear this spectrum to more than meet their expectation to its continued use – more than six years from our announcement of the beginning of the DDR on 17 November 2005[42] and writing to licensees to serve notice on 20 December 2005[43] (and possibly more than seven if PMSE access to the 800 MHz band can continue beyond 1 January 2012 up to the completion of DSO in late 2012). Again, we will consider representations from PMSE users who feel that there are special circumstances that in their view may entitle them to a different period of notice.

5.116 We will consult on all these considerations shortly.

Users who will not be eligible for funding

5.117 We have decided that the following groups of users will not be eligible for funding:

- users whose equipment does not tune to channel 69. The position of these users is not made worse by clearing channel 69;
- users whose equipment tunes to 69 but also tunes to channel 38. Again, these users are not left in a worse position by clearing channel 69; and
- users who have never held a licence to operate in channel 69 or who did not have legitimate reasons for allowing their licence to lapse for a period prior to the 800 MHz consultation. A licence is required for lawful use and we believe it inappropriate for public funding to made available to those who have only ever used channel 69 without a licence or who lack legitimate reasons for allowing their licence to lapse. The Government, which has indicated it will meet the costs of clearing channel 69, has made clear to us that it shares this view.

Our assessment of a 10 year equipment lifecycle

5.118 We accept that some PMSE equipment may have a longer lifecycle than 10 years. At the same time, we understand some may have a shorter lifecycle. We will therefore consult further on this issue to refine eligibility for funding accordingly.

How we calculate funding

5.119 Our reason for making funding available is to ensure eligible PMSE users are left in the same position as if we had not decided to clear channel 69. This would not be the case (indeed, such users would be left in a beneficial position) if funding decisions were based on the full value of replacement equipment.

5.120 We have therefore decided that the level of funding should be based on the unexpired lifecycle of equipment. Details of what this means in practice will be informed by consultation responses, as referred to above.

Next steps

5.121 We intend to consult on the following issues shortly:

[42] www.ofcom.org.uk/media/news/2005/11/nr_20051117.
[43] www.jfmg.co.uk/pages/Docs/FinalDSONoticeletter201205.pdf.

- the details of which PMSE users in the categories described in paragraph 5.112 should be eligible for funding;

- whether there are special circumstances in the case of any PMSE users of channels 61 and 62 and cleared spectrum that may entitle them to a different period of notice such that they, too, may be eligible for funding

- the precise details of the shared licensing arrangements for channel 38; and

- a more detailed approach to determining the lifecycle of PMSE equipment.

5.122 We will also seek further details from stakeholders to inform our decisions on how the funding mechanism for eligible PMSE users will work, including the likely scale of applications it will need to handle.

5.123 We expect that we will announce details of the funding mechanism in the autumn, with funding being available as soon as possible thereafter (and ideally before the end of the year). Before then, we expect the Government to provide certainty on the duration of PMSE access to the 800 MHz band (including channel 69) in September 2009 at the latest.

Conclusions

5.124 In this section we have outlined the proposals we made in the 800 MHz consultation in relation to moving PMSE from channel 69, summarised the responses we received and set out our assessment and decisions in light of these responses. In summary, we have decided to:

- allocate channel 38, which will be available on a UK wide basis from 1 January 2012, as the replacement for channel 69;

- award channel 38 to the band manager on the same terms as those previously planned for channel 69;

- allow PMSE users to access the 800 MHz band (including channel 69) until 1 January 2012 and possibly up to the end of DSO in late 2012 depending on the outcome of the work the Government will expedite to resolve the key questions raised by the ISB's report for Digital Britain. PMSE users will continue to have access to channel 36 on 12 months' notice to cease and to the rest of the 600 MHz band until the end of DSO;

- provide funding for the move from channel 69 to channel 38 subject to meeting our eligibility criteria; and

- confirm that funding will be available for:

    - those who meet the criteria set out in the 800 MHz consultation; and

    - those who can demonstrate to our satisfaction that they are rental companies that do not use PMSE equipment themselves but otherwise fulfil the criteria set out in the 800 MHz consultation.

5.125 We also outlined our planned next steps including further consultation on details of our eligibility criteria and how we will progress the development of a mechanism for disbursement of funds. Next steps are outlined in more detail in section 7.

Section 6

International negotiations

Introduction

6.1 This section outlines our approach to the international negotiations that we are undertaking to enable us to efficiently clear and award the 800 MHz band. Consistent with our statutory duties and our policy approach to the digital dividend, we are working to negotiate international transmission rights that are likely to secure the greatest benefits for UK citizens and consumers.

6.2 In section 2 of this document, we set out the framework for our existing international agreements, which provide the context for how we can use spectrum in UHF Bands IV and V. Before turning to the progress of international negotiations, this section first provides further information about the protections given under the GE06 Plan for DTT assignments in the UK and neighbouring countries.

Current international coordination agreements

6.3 Under GE06, the UK has spectrum rights to operate eight national DTT multiplexes (also referred to as layers within the GE06 process) in channels 21-68 of UHF Bands IV and V (excluding channels 36 and 38). These were based upon an interleaved frequency plan developed as part of the Digital Television Action Plan.[44]

6.4 Six of these layers were intended to be used by the existing six DTT multiplexes and are therefore located within the spectrum retained for broadcast use (i.e. channels 21-30 and 41-62). The remaining two layers were secured to provide the upper (channels 63-68) and lower (channels 31-40) bands of cleared spectrum. There are no UK international rights in place for channel 69.

6.5 Neighbouring countries also secured DTT allocations under GE06 that they will adopt as part of their DSO programmes. The UK is currently negotiating bilaterally with Belgium, France, Ireland and the Netherlands to finalise the detailed mutual implementation of the GE06 Plan and also to coordinate the UK's lower-power relays below 250 W which were not included in the GE06 Plan.

New international coordination agreements are needed

6.6 As we set out in the 800 MHz consultation, in addition to the ongoing negotiations to complete the international arrangements for DSO, new international coordination agreements will be required in order to accommodate the changes resulting from our decision to clear the 800 MHz band.

6.7 We need to agree revised transmission rights with our neighbours to enable us to:

- move the DTT assignments currently in channels 61 and 62 and use alternative spectrum when carrying out the subsequent replanning;
- secure appropriate rights to two DTT layers within the new 600 MHz band, and

[44] www.digitaltelevision.gov.uk/pdf_documents/publications/ActionPlanvs12_oct04.pdf.

- optimise (though not reserve) the 800 MHz band for use by two-way mobile services.

6.8 This means that some rearrangement of the retained spectrum will be required where DTT is moved from channels 61 and 62. To accommodate the preferred hybrid approach and retain DTT coverage, channels 39 and 40 will be used.

6.9 As some of our neighbours are also planning to release the 800 MHz band as their own digital dividend, they too need to agree revised international transmission rights with the UK and others. We are currently negotiating with neighbouring countries to agree revised rights on this basis.

Progress of international negotiations

6.10 To move DTT from channels 61 and 62 and replan these channels in the 600 MHz band, as well as to replan the 600 MHz band for potential use by additional DTT multiplexes, the UK must obtain bilateral agreements for any changes to GE06 with neighbouring countries on an equitable basis. Changes to the UK's GE06 assignments will affect those neighbouring countries, which may also be seeking to change their own GE06 assignments, which in turn could affect their immediate neighbours and so on across Europe. Thus, not just bilateral but multilateral engagement will be necessary to agree general principles and negotiate changes to GE06.

6.11 In the run-up to RRC-06 to establish the GE06 Plan, the UK participated in multilateral negotiations and in the North Sea Group, comprising Belgium, France, Ireland and the Netherlands with Germany and Luxembourg as interested observers. We are currently involved in setting up a similar cooperation group with these and other countries.

6.12 As more European countries decide to clear the 800 MHz band, channels 21-60 will be used more intensively for DTT. This is likely to result in requests to accept higher levels of incoming interference into the UK and vice versa, which will obviously have some impact on DTT coverage across the UK. As set out in section 4, a key criterion for our decision to clear DTT from the 800 MHz band is to ensure consistency with existing policy objectives for DTT coverage after DSO. Therefore, our principal aim will be to minimise any DTT coverage impacts for the UK which result from changes in the interference environment and bilateral coordination discussions. We will also aim to ensure that DSO plans are not materially disrupted.

6.13 To permit two-way mobile use of the 800 MHz band with minimal restrictions and without precluding other uses, the existing post-DSO DTT assignments in that band will need to be renegotiated through Memoranda of Understanding (MOUs) between countries. Through agreeing MOUs with our neighbours we will facilitate the roll out of networks without an excessive need for station by station coordination.

6.14 We are in the early stages of negotiating cross-border coordination agreements for the 800 MHz band with our neighbours: Belgium, France, Ireland and the Netherlands. We will continue to engage with these countries over the coming months through bilateral meetings to agree MOUs. These MOUs will be effective when both administrations make the 800 MHz band available for new services. Transition arrangements will be agreed that will allow either party to continue with broadcast services (in accordance with GE06 and agreed with the neighbouring administration) for some time.

Expected timescales for completion of negotiations

Moving DTT and the 600 MHz band

6.15 We received responses to the 800 MHz consultation from broadcasters and multiplex operators which raised the impact of international negotiations on timescales for clearance. For example, it was noted that the required infrastructure reengineering – frequency planning and regional system design – can only begin after we have successfully renegotiated international transmission rights. It was suggested that where this was not achieved quickly, it would impact on the overall timetable for clearing the band and making the spectrum available.

6.16 We note stakeholders' views. Our expectation is that negotiations for the main high power GE06 assignments (needed to move DTT from channels 61 and 62 and to replan alternative channels) are likely to last well into 2010 and may not be finalised until 2011. However, we believe it is credible that agreements will be reached on a revised main station frequency plan in mid 2010 with a revised plan for relays following that. It is likely however that we will know enough with a sufficiently high level of certainty to take key decisions well before the respective plans are ratified.

6.17 We note that there will be some risk to proceeding in the absence of absolute certainty, but believe this is a relatively low risk and one which can be managed by focusing on priority sites and lower risk areas. We believe there is a strong prospect of having a sufficient level of certainty to take these key decisions, with respect to the relevant main stations, necessary to unlock the benefits associated with maximising integration of DTT clearance with DSO. We will also work to secure appropriate agreement for our proposals for two additional layers within the 600 MHz band within this timescale.

6.18 We also note that successful completion is dependent on the will to proceed of Belgium, France, Ireland and the Netherlands plus their neighbours, and the volume of technical work that is required to achieve satisfactory agreements.

800 MHz band

6.19 In parallel, we expect to agree revised interference arrangements for the 800 MHz band with Belgium, France, Ireland and the Netherlands through MOUs by mid 2010.

Conclusions

6.20 As noted in the 800 MHz consultation, France has a particularly aggressive timetable to clear broadcasting from 800 MHz to allow two-way mobile use of this spectrum and further increase the number of broadcasting layers in channels 21-60 by the end of 2009. This means we need to agree coordination arrangements for the 600 MHz band and an MOU for the 800 MHz band with France by the end of 2009. As we said previously, we believe this is attainable but challenging. Final planning will still depend on our ability to successfully conclude the main negotiations with all our neighbouring countries.

6.21 In conclusion we believe it should be possible to progress international negotiations for the main UK sites to agree in principle the essential aspects of use of the 600 MHz band for DTT and optimise the 800 MHz band for use by two-way mobile by mid 2010.

Section 7

Conclusions and next steps

Introduction

7.1 This section confirms that we have concluded that clearing the 800 MHz band is strongly in the interests of UK citizens and consumers. It therefore outlines how we plan to proceed with clearing the 800 MHz band, setting out a timetable for publishing our implementation plans and undertaking further international negotiations.

7.2 It also considers the implications for the cleared award of the policy goals identified in the Government's Digital Britain Final Report. The revised timetable for the cleared award and our plans for further consultation are set out in light of these developments.

7.3 We first summarise our decision to clear the 800 MHz band. Then we discuss the steps we need to take to carry out clearance of the band. Finally, we set out the timetable for awarding the 800 MHz and 600 MHz bands.

Summary of conclusions

Decision to clear the 800 MHz band

7.4 As detailed in section 3, following careful consideration of stakeholder responses to the 800 MHz consultation we have decided that we should clear the 800 MHz band. This is because under the most plausible demand outcomes we assess the net benefits of clearing the band are £2-3bn (NPV). Aligning the upper band of the UK's digital dividend with the spectrum planned for release by an increasing number of other European countries therefore has the potential to generate significant value over time for citizens and consumers, with net positive impacts on most stakeholders.

7.5 We are confident that we can mitigate and manage any short-term disruption to stakeholders by putting in place appropriate transitional arrangements, including funding where and to the extent appropriate.

Next steps to clear the 800 MHz band

7.6 As a result of our decision to clear the 800 MHz band we, together with key stakeholders, will begin implementing a clearance programme over the next few months. Our plans for clearing DTT and PMSE from the band are outlined below.

<u>Moving DTT</u>

7.7 As explained in section 4, to be able to meet our objective for a timely release of channels 61 and 62 while meeting the DTT migration criteria, prompt action is required both to take forward urgent aspects of implementation and to lay the foundations for successful delivery of the entire programme. This prompt action in key areas directly affects our ability to reduce impacts and increase benefits[45] and is dependent on the point at which certainty can be provided on key frequency assignments. We strongly believe there is a common interest among all the key

[45] Including the opportunity for integrating DTT clearance with DSO which significantly affects timescales, impacts on viewers and implementation costs.

stakeholders in this area and strongly encourage them to engage quickly and constructively. We intend to work closely with the directly affected stakeholders over the next weeks and months to seize the opportunities to reduce impacts and increase benefits. We outline below our immediate next steps in this area.

7.8 We also wish to keep a broader community of stakeholders informed and engaged with the implementation process as it develops. We therefore intend to share our plans for implementation as we develop them over the summer. We would expect these plans to include the following matters:

- programme management and governance arrangements (including establishing an internal steering group in July to oversee key decisions), which we expect would include decision-making processes and key decision points;
- the definition of functional workstreams together with how and when we propose to resource and take each forward. We outline below how we intend to take forward urgent planning activities; and
- an overall implementation timetable, noting that this will be subject to periodic review in the light of important ongoing planning and analysis.

7.9 A primary objective of the next few months is to allow us to gather the information, set up the programme structures and governance arrangements and secure the resources necessary to deliver the programme. This work will be informed by consultation responses and further dialogue with stakeholders as well as analysis we have undertaken over the last few months (including three external studies which we expect to be finalised for publication in July). As well as this important preparatory work, we will, in parallel, progress urgent spectrum planning work to inform our decisions later this year and early in 2010. In this respect we intend to utilise existing planning bodies to the extent possible, including instigating new work from:

- JPP – to prepare a new frequency plan for DTT multiplexes; and
- Digital UK through BIG – to develop a new transition plan accounting for the clearance.

7.10 We will ensure that additional resources are provided to both groups to carry out these activities alongside existing DSO related work. We will write to both groups proposing work instructions and resource arrangements.

7.11 In addition to the crucial and urgent activities which we propose these two existing bodies would undertake, we intend to establish a Technical Infrastructure Planning Group (TIPG). This group would be charged with providing a timetable for integrating DTT clearance with DSO where appropriate and the retrofit timetable where not. We will discuss membership and resource arrangements for this group with relevant stakeholders.

7.12 The primary objective of these three groups will be to allow key decisions to be taken by us as soon as possible. This will help reduce impacts on viewers by increasing scope for integration with DSO and by taking advantage of other opportunities to reduce impacts on viewers and other stakeholders.

7.13 We aim to work closely with multiplex operators and other parties directly affected by the changes over the coming months to resolve a number of detailed but important issues. We will be in contact with these stakeholders within the next few days. As

well as discussing the matters outlined above we intend to discuss a number of more specific issues including but not limited to:

- important milestones and roles and responsibilities of key stakeholders in taking this work forward;
- handling of the licence variations that we consider will be required to deliver DTT clearance;
- funding, financial and contractual matters[46] relating to DTT clearance including the processes and controls that need to be established; and
- taking forward important work on viewer impact mitigation including establishing communication and support arrangements.

7.14 We draw particular attention to the importance of this work in significantly reducing the potential impact on viewers. We believe that all the affected stakeholders have a common interest in reducing impacts on viewers by maximising the opportunity for integrating DTT clearance with DSO and for realising other viewer impact mitigation initiatives.

7.15 Table 1 below sets out a high level timetable for taking forward this work over the next six months, including noting key decisions and significant milestones.

Table 1. High level timetable for moving DTT

Action	Timing
Establish internal governance arrangements and commit resources required for implementation plans	Early July
Confirm JPP, BIG and TIPG instructions and resources to allow work to commence	Early July
Decision on hybrid option A or B approach	July
Detailed implementation planning	Summer
Publish plans for implementation including establishing governance bodies	By end September (with prior discussion with key stakeholders)
Establish key programme delivery bodies	End 2009 (though some functions may take longer to procure)
Confirm how the licensing, contractual and financial frameworks for clearance will operate	Late 2009
Draft DSO integration/retrofit plan	End 2009
Draft near-final UK main station frequency plan[47]	Early 2010

Moving PMSE

7.16 In section 5 we confirmed that channel 38 will be the replacement for PMSE use of channel 69. Users can therefore now begin to move from channel 69. Channel 69 (and the rest of the 800 MHz band) will remain available for PMSE use until at least the date when protection for UK radioastronomy use of channel 38 ceases, currently 1 January 2012. We recognise these timescales fall short of the three-year period we proposed and still believe to be reasonable – if challenging – for an orderly migration from channel 69 to channel 38. Depending on the outcome of the Government-

[46] This will include work to reconcile the effects of these changes during implementation with existing planned maintenance arrangements for DSO in multiplex contracts.
[47] Note that this is likely to be in advance of ratification of final international agreements.

expedited work referred to in section 5, it may yet be possible for PMSE access to the 800 MHz band to continue beyond 1 January 2012, up to the completion of DSO in late 2012. If that is not the case, we and the Government will need to consider how best to provide for an orderly migration. The Government's timetable for this aspect of Digital Britain suggests there should be clarity on this issue in September 2009.

7.17 Our next steps in helping PMSE users to move from channel 69 are as follows:

- we will publish a short consultation on additional criteria for eligibility for funding;
- we will also further consider the lifespan of PMSE equipment. This information will inform our assessment of the levels of funding required for eligible PMSE users; and
- we will commission a study to look at options for how the disbursement of funding can best be administered.

7.18 The work outlined above will feed into our decisions on how the funding for eligible PMSE users will be administered. We want to be in a position to announce our decision later in 2009, with the mechanism for administering funding in place as soon as possible thereafter.

7.19 Table 2 below sets out a high level timetable for taking forward this work.

Table 2. High-level timetable for moving PMSE

Action	Timing
Study on options for how funding can be administered	July 2009
Consultation on eligibility criteria	July to September 2009
Confirmation of duration of PMSE access to the 800 MHz band (including channel 69)	September 2009
Decision on funding mechanism	October 2009
Funding mechanism in place	Late 2009/early 2010
Channel 69 cleared	2012 (exact date to be confirmed)

Next steps in international negotiations

7.20 As outlined in section 6, international negotiations are needed in order for DTT to use channels 39 and 40 and to prepare the 800 MHz band for potential use by two-way mobile services. Here we reiterate the next steps, the expected timetable for these negotiations and our plans for transitional arrangements.

7.21 We expect to agree revised interference arrangements for two-way mobile use of the 800 MHz band with Belgium, France, Ireland and the Netherlands through MOUs by mid 2010. This will allow for the deployment of services other than broadcasting. These MOUs will be effective when both administrations make the band available for new services. Transition arrangements will be agreed that will allow either party to continue with broadcast services (in accordance with GE06 and agreed with the neighbouring administration) for some time.

7.22 We expect that agreements will be reached on a revised main station frequency plan to allow DTT to use channels 39 and 40 in mid 2010 with a revised plan for relays following that. We believe there is a strong prospect of having a sufficient level of certainty by this time to take key decisions with respect to the relevant main stations

necessary to unlock the benefits associated with maximising integration of DTT clearance with DSO. As acknowledged in section 6, this timetable is challenging and dependent on the cooperation of our neighbours and the amount of technical work that is required.

Next steps to progress the cleared and geographic interleaved awards

7.23 We are grateful for Government support for clearing the 800 MHz band as expressed in the Digital Britain Final Report. We also note its endorsement of many of the ISB's proposals, and we will need to consider the implications for awarding the 800 MHz band following the completion of that process. Given the Government's timetable we anticipate that we will be in a position to set out how we expect to proceed with the 800 MHz, 600 MHz and geographic interleaved awards in the late autumn.

Annex 1

Respondents

A1.1 We received 84 responses to the 800 MHz consultation. They were submitted by a range of interested parties across the broadcasting and telecommunications industries. 49 came from stakeholders in the PMSE sector. All respondents are listed below apart from six fully confidential responses and seven individuals who asked for their names to be withheld.

- Broadcasting sector and multiplex operators
  - Arqiva
  - BBC
  - Cable Europe
  - Channel 4
  - Digital UK
  - Five
  - S4C
  - Virgin Media Ltd
- Telecommunications sector
  - BT
  - Ericsson
  - GSMA
  - H3G
  - Intellect
  - Motorola
  - Nokia UK
  - Nortel Networks UK
  - Orange UK
  - Samsung Electronics UK
  - Telefónica O2 UK
  - T-Mobile
  - Vodafone

- WiMAX Forum
- Qualcomm

- PMSE sector
  - AMPS
  - Association of Professional Wireless Production Technology
  - Audio Technica
  - BECTU
  - Better Sound
  - Britannia Row
  - BEIRG
  - Burlington Baptist Church 1
  - Burlington Baptist Church 2
  - Butlins Skyline
  - Christchurch Baldock
  - Churches Legislation Advisory Service
  - Darragh, Michael
  - David Hall Systems
  - Digico UK
  - Dimension Audio
  - Elliot, Peter
  - Hall, David
  - Hawthorn Theatrical Limited
  - IBS
  - JFMG
  - Johnson, Paul
  - Mactaggert, Neil
  - Manton, Richard
  - Milton, Mary

- Musicians' Union
- Nicol, Howie
- Orbital Sound
- PLASA
- Pickering, Adrian
- Richmond Film Services
- Royal National Theatre
- RSD
- Rugby Football Union
- Spectrum for Programme Makers Forum
- St. John's Church
- Wakeman, David
- Wigwam Acoustics
- Wilson, John
- Wilson, Stuart

- Other
  - Burness, Sidney
  - Copsey Communications
  - Lamont, Richard
  - Ofcom Advisory Committee for Northern Ireland
  - Ofcom Advisory Committee for Scotland
  - RNID
  - Isle of Man Communications Commission
  - Kang, S.

A1.2 We carefully considered all the responses we received. Responses pertinent to the policy decision to clear the 800 MHz band are detailed and discussed in the main sections of this statement. Further stakeholder comments and issues relating to the implementation phase and our responses will be published shortly.

Annex 2

Impact assessment

Introduction

A2.1 The analysis presented in this annex and the Statement as a whole represents an impact assessment, as defined in section 7 of the Communications Act 2003.[48]

A2.2 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best-practice policy-making. This is reflected in section 7 of the Communications Act, which means that generally we have to carry out impact assessments where our proposals would be likely to have a significant effect on businesses or the general public or when there is a major change in our activities. However, as a matter of policy, we are committed to carrying out and publishing impact assessments in relation to the great majority of our policy decisions. For further information about our approach to impact assessments, see the guidelines "Better policy-making: Ofcom's approach to impact assessment," which are on our website at www.ofcom.org.uk/consult/policy_making/guidelines.pdf.

A2.3 We do not consider that specific equality issues are raised at this stage but the impact on different groups of viewers and users is clearly relevant for implementation and will be considered as part of the relevant implementation work streams, in particular consumer communications and support.

A2.4 This Annex draws together our consideration of the points made by respondents relevant to Question 16, which focused on the Impact Assessment included at Annex 5 of the 800 MHz consultation:

Do you agree with our analysis of the key impacts of our policy options? Are there any other key impacts we should assess?

A2.5 The discussion in this Annex takes into account our review of the relevant issues and our consequent policy decisions as set out in the main document and other Annexes, with relevant references provided in this Annex.

A2.6 Our particular focus in this updated Impact Assessment is to identify key impacts of our policy options, relevant to the policy decisions set out in this statement. We note that our decisions will also have a range of important implications for implementing the clearance of the 800 MHz band, where future choices may affect the impacts on different stakeholders and how these should be addressed. The relevant implications will be addressed in subsequent Impact Assessments, including where relevant Equality Impact Assessments, when these distributional consequences have been defined in greater detail as part of our implementation planning.

A2.7 This impact assessment is organised as follows:

- First, we outline our objective for the DDR as a whole and two subsidiary objectives that the policy options examined in this impact assessment seek to meet. These serve to establish the criteria against which we evaluate the impacts of the alternative policy options;

[48] www.opsi.gov.uk/acts/acts2003/pdf/ukpga_20030021_en.pdf.

- We then summarise the impact assessment and the policy options examined in the 800 MHz consultation document, beginning with the base case of retaining the scope of the cleared award set out in the DDR statement and the cleared award consultation document, then outlining the alternative policy options of clearing DTT from channels 61 and 62 and/or clearing PMSE from channel 69;

- Thereafter, we turn our focus onto the key points made by respondents which could potentially affect our choice of core policy option. We have organised these into three main sections:

  - Comments on our **overall approach** to assessing impacts in order to inform our policy decision;

  - Comments on the **potential benefits** to citizens and consumers of clearing the 800 MHz sub-band; and

  - Comments on the **potential costs** to citizens and consumers of clearing the sub-band.

A2.8 Following a consideration of the points made by respondents in each of these areas, we set out our updated assessment of the impacts and our conclusions.

The citizen and/or consumer interest

A2.9 The digital dividend is of very significant value to citizens and consumers, not just in the UK but also in other European countries. Spectrum Value Partners estimated in March 2008 that allocating at least some spectrum in UHF Bands IV and V to mobile communications would generate €63-165bn (NPV over 20 years) for the European economy[49].

A2.10 It is therefore in the interests of citizens and consumers that the UK's digital dividend is configured and awarded in a way that is most likely to maximise the total value to society generated by using the spectrum over time. This is our objective for the DDR. In achieving this, we must have regard both to specific circumstances in the UK – including current and planned uses of this and adjacent spectrum – and evolving plans in other European countries and at the EU level.

Objective for the DDR

A2.11 In this Statement we have considered whether amending our previous proposals in order to clear DTT from channels 61 and 62 (which previously would have been interleaved capacity) and PMSE from channel 69 (which previously we had decided to omit from the award) would increase the total value to society generated over time from the use of the DDR spectrum.

A2.12 In assessing the different policy options available, we have borne in mind our objective for the DDR as a whole, as set out above, and two subsidiary objectives the policy options examined in this impact assessment seek to meet:

- minimising disruption to existing and planned authorised users of the 800 MHz band; and

[49] www.spectrumstrategy.com/Pages/GB/perspectives/Spectrum-Getting-the-most-out-of-the-digita-dividend-2008.pdf.

- ensuring the timely and orderly award of the cleared spectrum.

A2.13 While both these effects would ordinarily be factored into our assessment of the total value to society from the use of the DDR spectrum, we think it is important for us to pay particular attention to these two elements of total value for the purpose of this policy assessment.

Summary of the Impact Assessment we set out in the 800 MHz consultation

A2.14 In Annex 5 of our 800 MHz consultation, we identified four primary policy options that we believed would secure the above objectives, these were:

- **option A** – the base case of continuing with our current proposals;
- **option B** – clearing DTT from channels 61 and 62 and including the spectrum in the cleared award;
- **option C** – clearing PMSE from channel 69 and including the spectrum in the cleared award; and
- **option D** – clearing all three channels and including the spectrum in the cleared award.

A2.15 We examined the potential impact of the alternative policy options (options B, C and D) relative to the base case (option A) and the extent to which the policies impact on the total value to society the cleared award is likely to generate. Our assessment included both quantitative and qualitative elements.

A2.16 For the quantitative assessment, we modelled the key value impacts of spectrum being awarded under the policy options. Annex 3 provides an overview of this modelling work and presents its outputs.

A2.17 For each of the policy options we have made assumptions about each of the following:

A2.18 *Changing international constraints*: For the base case (option A), we assumed that no material changes to GE06 would be agreed, with only minimal renegotiation of existing agreements undertaken, thereby sustaining the ability for the UK to deploy both broadcasting and mobile communications networks in the upper band of cleared spectrum.

A2.19 We have assumed that implementing any of the three alternative policy options (options B, C and D) will require more material aspects of these arrangements to be renegotiated with neighbouring countries and that the following changes to GE06 would be agreed with neighbouring countries:

- rights to use the 800 MHz band would be renegotiated to facilitate mobile communications in both the UK and at least our most significant neighbours in interference terms – France and Ireland; and
- DTT assignments below channel 61 would be renegotiated to sustain, as far as possible, the opportunity for two new DTT multiplexes with UK-wide coverage to be deployed in the UK (as currently enabled by GE06).

A2.20 *Spectrum demand scenarios*: We modelled a range of demand scenarios to reflect the uncertainties relating to valuing this spectrum which is likely to be released at some point after DSO completes in 2012. We identified two specific scenarios which we considered were likely to encapsulate the most plausible outcomes:

- **scenario 1** – strong demand for mobile communications. This scenario involves strong consumer demand for mobile communications over the longer term (i.e. once the spectrum is available for use) and weak demand for other services; and

- **scenario 2** – strong demand for all services. This scenario involves strong demand for the spectrum over the longer term for all of mobile communications, DTT and MMS (mobile multimedia services such as mobile TV).

A2.21 We also tested the policy options against more extreme demand scenarios. The main demand scenario we used to stress-test our analysis was:

- **scenario 3** – strong demand for DTT. This scenario involves strong demand for DTT and relatively weak demand for mobile communications and MMS.

A2.22 *Economic value assumptions*: We have undertaken analysis to quantify the total changes in economic (i.e. producer and consumer) value that would occur as a result of spectrum awarded under each alternative policy option under each market scenario examined.

A2.23 The key assumptions we used were:

- spectrum would always be awarded to one or more of four uses – mobile communications, the provision of additional DTT multiplex capacity, MMS and PMSE;

- we valued mobile communications in an FDD configuration;

- the FDD value of spectrum is assumed to reflect its opportunity cost in terms of transmission cost savings for deploying Long-Term Evolution (LTE) relative to networks at a higher plausible frequency for LTE – 1800 MHz, as discussed in annex 3;

- the value of spectrum used by DTT is estimated on a similar basis to that set out in the DDR statement, with our analysis updated to reflect more recent assessments of future service demand together with the assumed revisions to GE06 implied by the alternative policy options. These could effectively preclude the economic deployment of high-power DTT networks in the upper band of cleared spectrum and alter the marginal values of spectrum in the lower band;

- the value of spectrum used by MMS was estimated on a similar basis to that set out in the DDR statement. Some of the parameters were updated to include data on currently deployed nascent mobile TV services at 2.1 GHz and the result of the L-Band auction; and

- we assumed that the value generated by PMSE would be constant under all policy options.

A2.24 In addition to these underlying values, our modelling sought to reflect the potential impact of international and other constraints on the use of particular spectrum in the policy options examined. The most important impacts reflected in the analysis were:

- the value for mobile communications use of cleared spectrum being aligned to the CEPT FDD plan for the 800 MHz band. This is expressed in terms of a value reduction in non-harmonised deployments;
- the amount of spectrum needed to deliver high-coverage DTT multiplexes;
- the broad impact of the geographic UK constraints implied for interleaved spectrum as an outcome of international negotiations; and
- the impact of the protection provisions proposed for existing UK DTT and continental radioastronomy on the value generated by new uses.

A2.25 The quantitative assessment also includes our estimate of the cost of clearing DTT from channels 61 and 62 and PMSE from channel 69 where relevant.

Economic impacts of alternative policy options

A2.26 In the 800 MHz consultation document we presented the net incremental economic effects of each policy option under the more likely market scenarios, relative to the base case. The results are reproduced in a summarised format in table A1. This shows the result of combining the higher-value demand scenario with the lower end of the range of implementation costs (and vice versa) to provide a range for the net economic benefits of the policy options.

Table A1. Net economic benefits as set out in the 800 MHz consultation document compared to base case of existing award scope (£m)

	Strong demand for mobile communication services; low implementation costs	Strong demand for all services; high implementation costs
Option B: clear channels 61 and 62 only		
Change in value from DTT	(80)	(400)
Change in value from mobile communications	2,000	2,000
Change in value from MMS	0	(200)
Implementation costs	(85)	(185)
Total incremental benefits of option B	**1,800**	**1,200**
Option C: clear channel 69 only		
Change in value from DTT	(20)	0
Change in value from mobile communications	800	800
Change in value from MMS	0	(200)
Implementation costs	(5)	(18)
Total incremental benefits of option C	**800**	**600**
Option D: clear channels 61, 62 and 69		
Change in value from DTT	(80)	(400)
Change in value from mobile communications	3,200	3,200
Change in value from MMS	0	(200)
Implementation costs	(90)	(203)

	Strong demand for mobile communication services; low implementation costs	Strong demand for all services; high implementation costs
Total incremental benefits of option D	**3,000**	**2,400**

All figures are present values in 2009 prices of economic benefits (producer plus consumer surplus) over the relevant evaluation period, as set out in annex 3. Total incremental benefits are rounded to the nearest £100m. The cumulative difference between services may not match the specified difference due to rounding.

A2.27 In the 800 MHz consultation document, we explained that a net improvement in the economic value of cleared spectrum was implied in all three alternative policy options (options B, C and D) relative to the base case (option A). In both demand scenarios, the greatest improvement arises under option D, when all three of channels 61, 62 and 69 are included in the cleared award.

A2.28 Under a reasonably wide range of plausible demand outcomes, our modelling suggested that the net total economic benefits of clearing all three channels, relative to the base case (option A), was in the order of £2.4-£2.9bn.

A2.29 Our assessment also included consideration of the potential impacts on specific groups of stakeholders. Some of these are included, in aggregated form, in the quantified analysis, while others were less easy to quantify. Following the aggregated quantified analysis, we provided a qualitative description of the impacts on specific groups of stakeholders. We identified the following groups that are likely to be particularly affected by the different spectrum awards implied by the alternative policy options:

- viewers of DTT carried by the existing six multiplexes after DSO;
- the associated DTT service providers – broadcasters, multiplex operators and the transmission network owner;
- licensed PMSE users;
- users of new services that are likely to be deployed in the digital dividend;
- new spectrum licensees and providers of these new services; and
- citizens generally.

A2.30 A full qualitative description of the impact on the above stakeholder groups was set in paragraphs A5.73 to A5.96 of annex 5 of the 800 MHz consultation.

A2.31 Finally, we concluded that that re-negotiating suitable revisions to international GE06 agreements to enable the replacement of channels 38-40 by 61, 62 and 69 could potentially deliver significant value to society over time with a positive net impact on most stakeholder groups.

Stakeholder comments on our overall approach

A2.32 Because the spectrum at issue is finite and unique in its characteristics, any proposed re-allocation from the existing one will inevitably entail differential impacts on different stakeholders. Accordingly our overall approach to impact assessment in the 800 MHz consultation was to:

- identify significant potential positive and negative impacts on citizens and consumers from the policy options;
- identify how any potential negative impacts (particularly on existing spectrum users) could best be mitigated within a given policy option; and then
- to weigh the different impacts in order to identify which policy option (if any) appeared, on balance, most likely to yield positive net benefits to citizens and consumers.

A2.33 Most respondents agreed with this basic approach and comments were instead focused on identifying impacts which respondents considered had not been properly assessed in applying the approach. One respondent questioned the validity of trading new consumer and citizen benefits against costs to existing licensees in the circumstances. However, we must take all relevant impacts on citizens and consumers into account in considering policy options, and where necessary we need to balance different, and sometimes conflicting, impacts in making our policy decisions.

A2.34 Accordingly, in updating the Impact Assessment for this statement, we have retained the same general approach adopted for the 800 MHz consultation. We discuss key points made by respondents on the component benefits and costs below.

Benefits

Ongoing value for mobile communications

A2.35 The main mobile communication network operators offered mixed views on our estimation of the potential value for mobile communications of our proposal to clear the 800 MHz sub-band, although all agreed with our view that the net benefits to citizens and consumers were likely to be substantial.

A2.36 On the one hand, Vodafone indicated that we had potentially been conservative in estimating the benefits concerned, while Orange and T-Mobile both proposed that we address the scope of the awarded spectrum to improve the value concerned – respectively by considering the case for clearing channel 60 in addition, and ensuring that the proposed protection clause did not reduce the mobile communications benefits of the cleared spectrum concerned.

A2.37 On the other hand, O2 made a number of comments on our mobile communications network modelling assumptions and in particular claimed that we had overestimated both absolute site numbers required for an equivalent LTE network at 1800 MHz and the relative number of sites at 800 MHz. They also suggested that the efficient bandwidth for such networks was potentially greater, at 2x15 MHz, such that we had overstated the number of discrete networks that would be deployed at 800 MHz, particularly given the potential for network sharing. H3G also stated that 2x15MHz could be the minimum efficient bandwidth for LTE.

Our response

A2.38 In modelling the potential mobile communications benefits of our policy options, we have in general taken a conservative approach, for the reasons set out in the 800 MHz consultation – the benefits could therefore be higher than shown in the Impact Assessment. However we believe that such a conservative approach is appropriate in the circumstances, given the inevitable uncertainties surrounding any quantification of potential future benefits and costs of this nature. However, because this approach suggests that net benefits of our preferred policy option are likely to be material even with generally conservative assumptions, we consider that there is less need to examine "upside" alternative assumptions in the Impact Assessment, and have retained the basic assumptions and approach to benefits modelling set out in the 800 MHz consultation.

A2.39 The case for clearing channel 60 of DTT transmissions was not assessed in our 800 MHz consultation because such a policy option would not be required to enable the harmonised band plan for the 800 MHz sub-band that has been developed by CEPT, as explained in our 800 MHz consultation. As set out in section 3, we have continued to restrict our assessment of policy options to those set out in the 800 MHz consultation, and this has been reflected in this updated Impact Assessment.

A2.40 Similarly detailed assumptions in relation to the proposed protection clause are beyond the scope of this Impact Assessment, as the details and hence the economic impacts of this proposed approach to licence conditions has not been finalised. Our modelling assumption in the 800 MHz consultation, that the condition would have a material impact on the value of some of the 800 MHz spectrum, reflected our conservative approach to the Impact Assessment, which we have retained.

A2.41 In the modelling used for the Impact Assessment in the 800 MHz consultation, we did not explicitly test if the absolute site numbers required for a given network rollout would be the most profitable rollout in specific circumstances, and in particular did not assess what the optimal number of sites might be for a network built to use higher frequency spectrum. We note that the assumed cost of the higher frequency network in our modelling was around £2bn, around 1% of the forecast turnover of the UK mobile telephone market between 2012 and 2026[50]. We believe that this level of expenditure would be affordable in the long run.

A2.42 On the issue of relative site numbers between frequency bands, 02 made reference to the site ratios of firms using either 900 MHz or 1800 MHz spectrum to build GSM networks. Ofcom's analysis was based on more advanced technologies (LTE). GSM and LTE are significantly different technologies so that GSM site ratios cannot be directly compared with LTE site ratios. The key differences between the technologies that mean that they cannot be compared directly are:

- Greater flexibility in resource scheduling within the Orthogonal Frequency Division Multiple Access (OFDMA) air interface, allowing interference to be largely avoided when loading is not too high.

- The use of Multiple Input Multiple Output (MIMO) technology, increasing the throughput for given signal conditions.

[50] The forecast of total UK mobile telephone market turnover is from: Analysys Mason Western European mobile market: trends and forecasts Data Annex.

- The support for variable bandwidths, which can increase or decrease differences between bands given different available bandwidths.

- Fine-grained adaptive modulation and coding techniques, increasing spectrum efficiency.

A2.43 Our analysis of the likely benefits was based on each of three networks using 2x10 MHz. 02 and H3G argued that an operator could acquire more than 2x10 MHz, and that we had therefore overstated the benefits associated with three networks. In an efficient and fair auction, this could only occur if it was more economically efficient for one firm to hold more spectrum than for it to be split between two firms. We consider that 2x10 MHz could be sufficient for a single operator, so our results provide a floor to the benefits.

A2.44 We did not seek to quantify the benefits of 800 MHz spectrum when acquired by operators who plan to enter into network or spectrum sharing agreements. 02 argued that network or spectrum sharing would reduce the cost advantage of 800 MHz spectrum that we had estimated. Operators who share networks or spectrum should be able to rollout to a greater percentage of the population than operators who build individual networks (as each additional site is cheaper), which provides a benefit to citizens and consumers. So whilst sharing can reduce the cost advantage, it also provides an additional benefit, which is inherently difficult to quantify without detailed information on the nature of any potential future sharing agreements. Accordingly in our modelling we focused on the cost advantage of networks of comparable coverage and did not attempt to estimate revenue impacts associated with sharing scenarios.

A2.45 Given the above considerations, we consider the modelling assumptions used for the analysis in the 800 MHz consultation still to be appropriate and have retained them for this Impact Assessment.

Benefits of earlier release

A2.46 A number of communications providers including BT, H3G, T-Mobile and Orange argued that there could be material benefits if earlier release of the spectrum cleared as a result of our proposals could be secured. Such benefits could include:

- non-LTE use of the 800 MHz sub-band (which was not dependent on the availability of new harmonised LTE equipment);

- greater competition benefits provided from the earlier availability of spectrum suitable for mobile communications;

- benefits within the 800 MHz sub-band that could be secured by earlier national release of channel 69 and/or channel 62; and

- benefits, such as the availability of spectrum to support early regional wireless broadband deployments, from regional releases staged in line with DSO.

Our response

A2.47 We accept that in principle timing of spectrum release could affect the total costs and benefits evaluated in our Impact Assessment.

A2.48 In this context we accept that in principle there are potential benefits to securing earlier national release of the whole or part of the 800 MHz sub-band, and/or earlier regional release. We also accept that the timing of release could potentially affect the specifics of wider competition benefits, and this will be an important consideration in finalising our implementation and award plans.

A2.49 However, in its Digital Britain final report, the Government recently set out an integrated package of policy proposals to address a range of key spectrum issues associated with the future provision of mobile broadband services in the UK. As well as 800 MHz spectrum, these proposals involve a number of other frequency bands. Accordingly, detailed evaluation of the associated competition issues in the 800 MHz sub-band will require further progress in addressing these issues, as set out in the Digital Britain final report.

A2.50 Any associated additional competition benefits are not required to support our basic decision on whether or not to clear the relevant channels. Where costs and disruption as a result of earlier release are certain and benefits, while available in principle, are at best uncertain in practice, we need to be particularly conscious of the risks of the cost of our policy unexpectedly outweighing the benefits and hence there being a potential regulatory failure as a result of our actions. Avoiding such risks is another of our objectives for future PMSE spectrum access.

A2.51 Moreover, as discussed in our 800 MHz consultation and in section 5 in this statement, the likelihood of early use of the 800 MHz band by new services may become significantly clearer in the near future as a result of the work the Government will expedite to resolve the key questions raised by the Independent Spectrum Broker's report for Digital Britain. In this context, any provision for the benefits of earlier access to this spectrum would not be consistent with a conservative approach to the Impact Assessment at this stage.

A2.52 Instead we assessed benefits in the 800 MHz consultation based on a conservative assumption of UK clearance of the 600 MHz sub-band by the end of 2012 (with channel 36 available from 2011) and the 800 MHz sub-band by the end of 2013, given that this timing still requires delivery of a challenging clearance programme for channels 61 and 62 that is integrated with DSO where practicable. As discussed in section 4, we still think this is a realistic target for the purpose of this Impact Assessment under our proposed hybrid option (although we note that a further six (or more) months could be added to the overall clearance timetable for channels 61 and 62 if the hybrid option could not be implemented with some regional integration with DSO as proposed, for any reason).

Impact of clearance requirements on timing of benefits

A2.53 Some respondents, including Arqiva and DUK, believed the international negotiation and clearance programme timing assumptions we made in our 800 MHz consultation to be too optimistic, and accordingly proposed that our Impact Assessment should assume a later start to the benefits identified in the upper sub-band - with a start date later in 2014 (versus the beginning of 2014) being proposed.

A2.54 However T-Mobile were concerned about the potential loss of benefits which could arise from such a delay in clearance into 2014 (or later), noting that in our recent consultation on the liberalisation of GSM spectrum at 900 and 1800 MHz, we had

identified the risk of a similar material loss of benefits arising with a delay of less than a year.

Our response

A2.55 As discussed in section 4, we still believe that end-2013 is a realistic if challenging target to achieve the full clearance of the upper sub-band, and is consistent with our proposed adoption of the Hybrid option for clearing channels 61 and 62, coupled with the conclusion of the key associated international negotiations in 2010/11. We expect to take key decisions by the end of 2009 (in advance of international agreements being ratified, although we think it is likely that we will have sufficient certainty to do so), so that work can commence on the necessary draft frequency plan to support clearance within this timescale. We recognise that any such timing will have significant risks, which will need to be managed via the programme management arrangements we are putting in place, as set out in section 4. However, as noted below, we are aware that delay would potentially imply significant losses of benefits to citizens and consumers.

A2.56 Accordingly we believe that it remains appropriate to retain a target date of end of 2013 for the full clearance of the 800 MHz sub-band as the central case on which to estimate expected net benefits in this Impact Assessment. However, to address points made by respondents in relation to programme risk, we have also examined the impact of a 1 year delay as a conservative sensitivity, and the results are shown in Annex 3 and discussed further in paragraphs A2.94 to A2.95 below.

Harmonisation benefits have been potentially underestimated

A2.57 Some respondents queried the accuracy of our approach to quantifying the harmonisation benefits arising from clearing the sub-band; Intellect and Nokia both suggested that reduced service using standard mobile communications receivers, rather than the deployment of non-standard receivers, would be the probable outcome of making non-harmonised spectrum available in the 800 MHz sub-band in the relevant award (versus the assumption we used in the 800 MHz consultation of non-standard receivers).

Our response

A2.58 If a duplex spacing of 41 MHz now proposed by CEPT[51] was adopted as part of a relevant UK award, and channels 61-62 and 69 were not to be cleared, then only 2x5 MHz of cleared spectrum would be available for harmonised FDD use in the 800 MHz sub-band. If a non-standard duplex spacing was instead used, then up to 2x15 MHz of cleared spectrum could be available for FDD use within the total 48 MHz of spectrum available. Even with the substantial costs of non-standard receivers, we expect that an award outcome that resulted in such higher spectrum usage would be plausible.

A2.59 While the actual market response to such provision of non-harmonised spectrum in a future award is inevitably speculative at this stage, we therefore consider that the identification of harmonisation benefits via an illustrative assumption of non-standard receiver costs remains appropriate for this Impact Assessment, given the substantial increase in spectrum which would be available for use under the

[51] See figure 3 in section 2 for the proposed CEPT band plan

relevant scenario. Accordingly, we have not amended our modelling approach to the estimation of harmonisation benefits for the purpose of this Impact Assessment.

Carbon benefits not examined

A2.60 Intellect noted that network savings would also deliver carbon benefits we had not allowed for.

Our response

A2.61 We accept that transmission network savings can deliver carbon benefits in some circumstances. However such benefits are a function of the specific networks affected, and in the context of our proposed technology and service neutral awards, it is difficult to represent details of such networks in either the base case or the alternative policy options in sufficient detail to attempt to quantify differential carbon savings. Recent research published by Ofcom has indicated that transmission network impacts are relatively minor compared to receiver equipment impacts on carbon consumption. Hence, while exclusion of carbon benefits from our assessment would potentially imply a small conservative bias to our evaluation, we do not believe it will materially affect the outcome and hence have not updated the analysis in the 800 MHz consultation for this effect.

Costs

Viewer impacts

A2.62 The PSBs and multiplex operators believed we had underestimated the negative impacts on viewers of the proposed frequency changes to the existing six multiplexes, with five key areas being highlighted in the different responses:

- **The time costs of viewers' own retuning** for the premises affected should be higher, and that two (or more) retunes could be required for some viewers under the options requiring the clearance of channels 61 and 62, with some being required to undertake these retunes shortly after DSO.

- As well as viewers' own time costs, **professional assistance costs** (for new/changed aerials, supplying other new receiving equipment and/or to carry out more complex retuning exercises) should also be included. Private respondents also raised the additional professional costs of retuning required for communal aerials and built-in receivers – where some of the costs that are currently planned to be incurred under DSO would need to be repeated.

- **Extended communications and Digital Switchover Help scheme (DSHS) costs**, the hybrid option could result in the existing existing DSO programme (including infrastructure and associated costs) extending beyond 2013, including for the vulnerable and elderly, and hence should be included.

- **Loss of expected DTT coverage benefits for some viewers** from the commercial multiplexes as a result of the hybrid option; because the number of households affected could potentially run into tens of thousands, such impacts should be more comprehensively evaluated.

- **Loss of wider DTT platform confidence** was likely, due to the additional retunes that were going to be needed (relative to existing DSO plans) for a large

number of viewers until the completion of the clearance of channels 61 and 62, and as a result of viewers losing DTT coverage.

Our response

A2.63 As described in section 4, our updated analysis estimates that around 11 million households plus a further 2 million commercial premises (totalling 13 million premises in total) will potentially be required to retune DTT equipment under the hybrid option. Based on the current proportion of residential premises watching DTT on at least one television set (70%) and the maximum proportion of analogue only premises which are yet to acquire DTT at DSO (a further 10%), we assume that up to 80% of the 13 million premises (i.e. 10.5 million) could be affected. We consider this to be a conservative theoretical upper limit and hence have now used this 10.5 million figure as an upper limit for the affected premises in this updated Impact Assessment.

A2.64 However in practice, we will be working to reduce the number of premises actually affected, through careful detailed planning of the DTT clearance programme, as set out in section 4. While these plans are still being developed and considerable further analysis is required, we believe that it may be possible to halve the number of affected premises and will work with the relevant stakeholders to realise these reduced impacts.

A2.65 As noted in section 4, we believe that viewers' understanding of retuning is likely to increase significantly in any event as DSO progresses and DTT platform familiarity increases. We understand that an industry-wide initiative is being developed to promote periodic retuning as a matter of routine TV maintenance or "hygiene". This initiative is being developed in recognition of viewers' ongoing needs and should limit any viewer impacts from retuning activity. Given this, we expect that the average time per retune of 15 minutes assumed in the Impact Assessment in the 800 MHz consultation is likely to prove conservative.

A2.66 Nevertheless, it is also possible that more than one retuning exercise may be needed at some premises before the clearance programme is complete (e.g. where intermediary parking channels are required). The number of affected premises, and hence the importance of this effect on the overall national average impact per premises, will depend on the final frequency plan to be implemented and negotiations with international neighbours. However we consider it unlikely that more than two events will be required for any household and the vast majority of households will only have to undergo a single retuning event. Further, where multiple events do occur within same households, each retuning event should in principle, for most people, be simpler and quicker to carry out because they will be gaining further experience to do so. Accordingly the effect of multiple retunes in some premises on the overall national average impact is likely to affect less than 10,000 households and we have not included the impact of second retunes in our analysis.

A2.67 Overall therefore we consider that the average retuning time of 15 minutes per premises used in the 800 MHz consultation remains appropriate for this consultation, and therefore our conservative viewer time cost of £15million (NPV) for this Impact Assessment remains appropriate. This assumes that any secondary retunes that are necessary do not take any material length of time.

A2.68 In the 800 MHz consultation, we noted that the Hybrid option might require around 10,000 households to incur professional assistance costs to change aerials. We

assumed average cost of £150 per affected household giving a total estimated cost of around £1million. Affected premises incurring expenditure could include commercial and community premises, where professional retuning (rather than aerial changes) may be required on channelised communal aerials. We are carrying out further analysis to better define the scale of this issue; however, from initial discussions, including with DUK, we believe an upper limit on the potential costs could be around £30million though a figure of around £15million is consider more likely[52]. We have therefore adopted a £15million-£30million cost range for this Impact Assessment.

A2.69 Our earlier 800 MHz consultation estimates already included allowances for other relevant clearance implementation programme costs, including for communications support, infrastructure and associated costs, to the end of 2013. If costs were extended into 2014, then we consider that a portion of the relevant communications and support cost profile would in general simply be moved to start at a later date, so that the aggregate costs involved would be unlikely to change materially. We note that extending the DSHS is a decision for government, and is just one way to provide support to viewers; there are also other options which may be more appropriate once DSO completes.

A2.70 We believe that, while there may be some commercial multiplex coverage loss relative to some DSO base case assumptions, this is likely to be very limited (potentially less than 20,000 premises), and should be considered against the potential improvements in PSB coverage achieved for some other viewers. In net benefit terms, we currently estimate that this implies coverage changes of less than 20,000 homes (although impacts will also be dependent on the international agreements reached with our neighbours, it will be difficult to assess the exact impacts of hypothetical international agreements in the absence of UK clearance). Even if a net 20,000 premises lost coverage and had to take a free satellite service at a one-off cost of £200-£250 per home to restore it (which may not be least cost option in all such circumstances)[53], the economic effect in terms of additional consumer cost would be of the order of £5million (NPV), which we have now included in this Impact Assessment.

A2.71 While the requirement for some viewers to undertake additional retunes after DSO may lead some viewers to contemplate switching platforms, we believe the likelihood of actual switches as a result of the 800 MHz clearance to be low. We are starting to see evidence of awareness among some consumers that, in order to receive changing channel line-ups on DTT, their receivers occasionally need to be retuned in any event. The main, but unpredictable, drivers of platform switch (including the relative quality and cost of content) are therefore more likely to be common to the base case and policy options. We note that periodic refreshment is not distinct to the DTT platform, for example, Sky satellite subscribers undergo a periodic replacement programme of their conditional access system every few years. We therefore do not think such effects are sufficiently material or predictable to include in this Impact Assessment. We will consider the impact on specific categories of user during the implementation process.

[52] To reach this estimate we assumed that there are six million multiple dwelling units averaging ten units per block resulting in an average of 0.6m blocks (and communal aerial systems). Up to 50% of these will be affected by retuning (although we expect this to be a conservative figure as London which has a high proportion of flats will not be affected). This establishes 0.3m blocks affected by retuning as a theoretical upper limit. We estimate that 20-50% of these blocks may have channelised aerials (leaving around 60,000-150,000 affected systems). At an assumed cost of up to £250 per aerial system we estimate the cost range to be between £15million-30million (NPV).

[53] This assumes that each household will require two new satellite set top boxes.

DTT provider impacts

A2.72 The same parties also stated that DTT provider costs had been understated in our 800 MHz consultation Impact Assessment in five key areas:

- DSO programme risk.
- Planning and design resource for the clearance programme.
- Broadcaster management effort.
- Post-DSO operating expenditure on RBL replacement lines (to address coverage losses).
- Loss of revenue due to coverage loss.

A2.73 Some broadcasting respondents suggested that reliable cost estimates could only be prepared when detailed site planning had been completed and called for a new Impact Assessment when the clearance programme had been more completely defined.

Our response

A2.74 Under our DTT migration criteria, we have made it a key objective to ensure that the consequences of our policy decision does not materially adversely impact DSO as set out in section 4; where a material risk to the DSO programme could arise as a result of clearance, we will ensure appropriate mitigation mechanisms are put in place to minimise that risk.

A2.75 As set out in Annex 3, if the risks to the new clearance programme for channels 61 and 62 were nevertheless to crystallise, and hence it was only able to deliver the net benefits up to a year later (an outcome which we do not expect), such delays would reduce total net benefit by up to £400million. While such a loss in net benefit would be very significant for citizens and consumers, it would represent less than 20% of the total estimated net benefit of our policy decision, which therefore would remain robust to such a significant delay.

A2.76 We have confirmed in section 4 that the 800 MHz consultation bases for our estimated costs for the implementation programme remain appropriate for this Impact Assessment. These costs already included allowances for planning and design resource and related broadcaster management input (incremental to the base case option, where some adjustment in response to international coordination requirements would have been needed in any event). We have not included time necessarily incurred to attend and prepare for meetings which are required as part of normal regulatory interactions. We do not think that there should be any significant loss in coverage and or any significant increase in relay operating costs. Hence, even if there are small costs to broadcasters in terms of revenue loss or increased operating costs these are likely to be marginal for the purpose of this Impact Assessment. We think that the risk and nature of temporary coverage-related revenue losses for specific broadcasters are limited and extremely difficult to quantify. We note that the management of engineering downtime is an ongoing necessity for all television platforms, and that those involved (Arqiva and the affected broadcasters) are very experienced in managing downtime to minimise impacts. Most households that lose DTT coverage and hence switch to an

alternative platform are likely to switch to a free-satellite service where the line-up of channels is broadly similar to DTT. Given the similar line-up of channels, the competition for viewers on DTT and a free-satellite service is likely to be broadly similar. Hence both the per-household and total revenue losses are likely to be minimal. However, we have conservatively included an estimate of the consumer impact of losses in coverage (as set out in paragraph A2.63 above).

A2.77 Similarly we do not think that the proposed Hybrid option is likely to result in material revenue loss due to permanent additional viewer churn from the DTT platform, as the net coverage losses arising from the preferred Hybrid option (relative to the base case) are expected to be very limited as a consequence of applying our mitigation criteria, as discussed in paragraphs A2.68 to A2.71above.

A2.78 We have therefore not updated our Impact Assessment for such industry revenue impacts (but nevertheless remain open to representations from individual stakeholders if there are particular cases of material viewer coverage losses to consider).

Other potential impacts

A2.79 The BBC also suggested that the Impact Assessment did not address the negative impact on the potential value of a 7th multiplex for new DTT services.

A2.80 Virgin Media stated that the potential cost of remedying possible interference to 3million plus cable households arising from two-way mobile communications services in the 800 MHz sub-band needed to be investigated. Virgin Media claimed that the significant potential costs involved needed to be included in our cost-benefit analysis.

A2.81 RNID stated that the potential cost to users of audio induction loop systems currently reliant on channel 69 had not been investigated.

A2.82 One respondent (who wished to remain anonymous) indicated that the negative impact of mobile communications use of channel 69 on its use of channel 70 needed to be examined, while several respondents suggested that other channel 70 equipment would be devalued, with this unlicensed channel also becoming more congested in consequence.

A2.83 Finally, a private respondent suggested the environmental cost of redundant channel 69 microphones needed consideration.

Our response

A2.84 We took account of the effect of reduced coverage of new additional multiplexes using the digital dividend spectrum in the Impact Assessment in our 800 MHz consultation, along with the impact of some households having to upgrade aerials to receive the additional multiplex broadcasts concerned. No additional information has subsequently been provided to us that would cause us to update our estimates of the impacts of clearing the 800 MHz band for this Impact Assessment.

A2.85 We have subsequently investigated the cable interference raised by Virgin Media. Our understanding of the issue raised by Virgin is that it is one of electro-magnetic compatibility (ECM) between cable systems and any new services using the 800 MHz band. Accordingly, any such issue would arise in both the base case and our

preferred policy option, and hence any impacts should not be included in this Impact Assessment.

A2.86 We have investigated the issue of the potential impacts of our proposals for users of induction loop systems, and met with representatives of the RNID to understand their concerns. We understand that the utility of an induction loop system is not affected by the frequency in which a wireless microphone which acts as an input to it operates. As a result, an induction loop system will work equally effectively whether it is being used in conjunction with a channel 69 wireless microphone or with a channel 38 microphone.

A2.87 We are aware of the particular services deployed in channel 70 over which the concerns have been expressed. In this context we have met with the relevant stakeholders and other interested bodies and have been made aware of the specific characteristics of the relevant devices. As a result, we will be investigating further with the primary user any potential impact of likely services deployed in channel 69 into services in channel 70. We agree that, as part of the scheme for compensating users who replace wireless microphones, we will need to manage the attendant environmental impacts carefully. We will be consulting on the detailed implementation plan for clearing PMSE from channel 69 shortly after the publication of this statement. Subject to such management arrangements being included in this plan, as set out in section 5, we consider at this time that the replacement of wireless microphones will not have material adverse environmental impacts affecting the policy decision addressed in this Impact Assessment.

Updated impacts

A2.88 Taking the above into account, along with the adjustment to the estimated costs of clearing channel 69 that we discussed in section 5, we have updated the quantified estimates of economic impacts of the four policy options under three alternative demand scenarios set out in our 800 MHz consultation. The results are set out below and discussed in the following paragraphs.

Table A2 updated net economic benefits compared to base case of existing award scope (£m)

	Strong demand for mobile communication services; low implementation costs	Strong demand for all services; high implementation costs
Option B: clear channels 61 and 62 only		
Change in value from DTT	(90)	(400)
Change in value from mobile communications	2,000	2,000
Change in value from MMS	0	(200)
Implementation costs	(100)	(220)
Total incremental benefits of option B	**1,800**	**1,200**
Option C: clear channel 69 only		
Change in value from DTT	(30)	0
Change in value from mobile communications	900	900
Change in value from MMS	0	(200)
Implementation costs	(15)	(30)
Total incremental benefits of option C	**800**	**700**
Option D: clear channels 61, 62 and 69		

	Strong demand for mobile communication services; low implementation costs	Strong demand for all services; high implementation costs
Change in value from DTT	(90)	(400)
Change in value from mobile communications	3,200	3,200
Change in value from MMS	0	(200)
Implementation costs	(115)	(250)
Total incremental benefits of option D	**2,900**	**2,400**

A2.89 It can be seen that, on the basis of our modelling assumptions, Option D - clearing all of the 800 MHz sub-band - continues to yield the greatest aggregate net economic benefit to citizens and consumers, relative to the base case Option A (not clearing any additional channels), with this aggregate net benefit still estimated to lie in the range of £2.4-£2.9bn on the basis of the two demand scenarios (1 and 2) that we consider to be the more plausible.

A2.90 This is because, when net benefits are rounded to the nearest £100million, the changes in the estimated costs of clearance that we have made in the quantified analysis, including as a result of consideration of responses to the 800 MHz consultation, as discussed in preceding paragraphs, are relatively minor when set against the substantial economic value we estimate will arise from clearing the three channels concerned.

A2.91 As discussed above, we have not changed our estimates of this economic value from those set out in the 800 MHz consultation. They remain focused on the value of enabling much greater access to spectrum in the 800 MHz sub-band that will be harmonised for mobile broadband use across key European markets. This benefit more than offsets the relatively limited potential reductions in the incremental value of additional spectrum for DTT and (in Scenario 2) MMS services which our modelling suggests could occur.

A2.92 Our estimates of clearance costs have increased from those provided in the 800 MHz consultation in two specific areas, following the further analysis discussed in sections 4 and 5:

- Securing our objective of minimising disruption to viewers of existing DTT services, by refining our estimates of additional costs incurred in retuning and adjusting receiver and transmitter equipment, and where households lose coverage of commercial multiplexes in the options where channels 61 and 62 are cleared, as set out in section 4 and in paragraphs A2.70 to A2.71above.

- Securing our objective of minimising disruption to PMSE users, by allowing for some additional costs incurred in replacing stranded equipment in the options where channel 69 is cleared, as set out in section 5.

A2.93 In aggregate these changes imply increases in estimated total clearance costs in policy option D (clearing all three channels) from the £90millio-£203million range set out in the 800 MHz consultation to £115million to £220million. Set against the unchanged estimates of economic value secured from the clearance concerned (£2.6billion-£3.1billion in the two more plausible demand scenarios), these revised estimated clearance costs are relatively minor in their effect on the quantified

Impact Assessment – Option D (clearing all three channels) remains the alternative which is likely to yield the largest net economic benefit.

A2.94 As discussed above we have however also examined the potential effect on these estimated net benefits of a delay to the clearance of channels 61 and 62, given the views expressed in the 800 MHz consultation that our target for complete clearance before the end of 2013 may entail significant risk. As set out in Annex 3 we have evaluated this risk for the Impact Assessment by examining, as a sensitivity, the potential impact of a one year delay to the clearance of these channels and hence the national availability of the upper sub-band.

A2.95 The results of this sensitivity suggest that the net benefits of Option D (clearing all three channels) would be reduced by £0.4billion to £2.0billion-£2.6billion in our two more plausible demand scenarios, but that Option D remains the option which would deliver the highest net economic benefit. The details of these assumptions are set out in Annex 3. While this sensitivity demonstrates the importance to consumers and citizens of proceeding with the hybrid clearance option in an expeditious manner, subject to mitigating risks to existing stakeholders through appropriate implementation arrangements, it also confirms the assessment in the 800 MHz consultation that Option D is best likely to meet our duties towards citizens and consumers overall.

A2.96 For the reasons set out in our 800 MHz consultation, we continue to believe this assessment of aggregate net economic benefits could prove conservative, both as a result of the conservatism we have sought to adopt in our modelling and because the quantitative assessment has not sought to include estimates of other, wider, economic benefits that could also prove to material. Among these, the facilitation of more intensive competition in the provision of mobile communications services in the longer term could be the most significant unquantified benefit.

A2.97 As set out in our 800 MHz consultation (paragraphs A5.73-A5.96) our policy will have differential impacts on different stakeholders. As our overall assessment of the aggregate net economic benefits remains broadly as set out in our 800 MHz consultation, we expect that the nature of impacts on individual stakeholder groups will also remain broadly as described that document. However, in order to achieve our objectives for implementing our policy, including the mitigation of adverse impacts on relevant existing spectrum users, we will need to set out our implementation plans in more detail for consultation. We aim to do this when the necessary planning work has been further developed, which will then provide the opportunity to prove an additional Impact Assessment of the associated implications for the stakeholders concerned.

Conclusion

A2.98 As can be seen from the above analysis we have updated a number of aspects of the Impact Assessment in our 800 MHz consultation to reflect further work and consultation responses. While we have adjusted some of the estimated clearance cost elements as a result, our analysis still suggests that the policy of clearing all three channels (61, 62 and 69) delivers the greatest overall net benefits to citizens and consumers, and that this conclusion is robust to the sensitivity test of a significant delay to clearing the spectrum of DTT use.

A2.99 We have therefore concluded that this represents the appropriate policy option to pursue, while, in line with our objectives, ensuring that affected stakeholders are not materially disadvantaged in consequence. Details of the arrangements to mitigate

such adverse impacts are being developed as part of our implementation plans, and will themselves be subject to further Impact Assessment

Annex 3

Economic modelling

Introduction

A3.1 This annex provides an overview of the economic modelling work we have undertaken to inform our assessment of the economic value of the four options set out in the impact assessment in annex 2:

- Option A (the base case): continuing with a cleared award based on the spectrum configuration in our Summer 2008 consultation but with an award date of Spring 201054;
- Option B: clearing channels 61 and 62 and including these as cleared frequencies in the award alongside the other frequencies (with the exception of channels 39 and 40);
- Option C: including channel 69 in the cleared award alongside the other frequencies; and
- Option D: a combination of both option B and C

A3.2 The incremental values outlined in this annex are not an indication of likely auction proceeds. We discuss the reasons for this later in this annex.

A3.3 The comments received on the methodology of the quantitative modelling and the inputs used in the modelling have been discussed in the Impact Assessment of this document. The exception to this is that we have assessed the scale of a one year delay to the usability of the upper sub band in paragraphs A3.84 to A3.87.

A3.4 We have restated our modelling assumptions to provide readers with a complete explanation of the details underpinning our quantitative analysis in the Impact Assessment of this document.

Methodology overview

A3.5 The economic value that the digital dividend spectrum can provide is dependent on two main demand factors and two main supply factors.

A3.6 For demand these are:

- consumer demand for services that may use digital dividend spectrum (potential DDR services); and
- the alternative ways of delivering the service without using digital dividend spectrum.

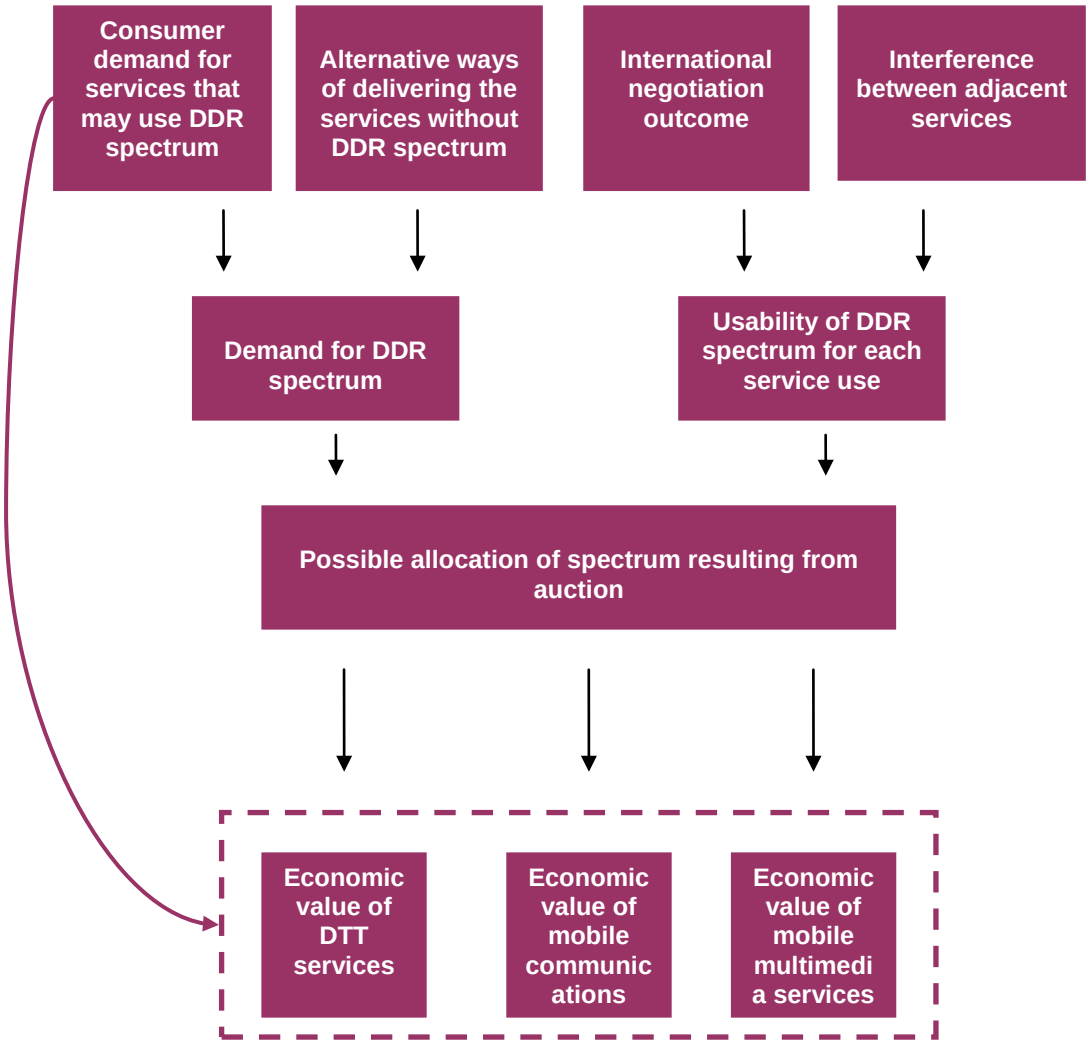
A3.7 For supply these are:

[54] http://www.ofcom.org.uk/consult/condocs/clearedaward/

- the usability of digital dividend spectrum for each potential service. This has two components:
    - the international negotiation outcome assumed; and
    - interference between adjacent services.

A3.8 Figure A2 below provides an overview of our modelling approach and shows how these factors fit into it.

Figure A2: Overview of modelling methodology



A3.9 From the demand for digital dividend spectrum and its usability for each potential service, we have made assumptions about the allocation of spectrum that may result from the auction.

A3.10 We have then sought to estimate the economic value associated with those allocations. These valuations are affected by the assumed demand from consumers for the underlying services. We have modelled economic values for three services:

- DTT services;
- mobile communications;[55] and
- MMS (mobile multimedia services such as mobile TV)

A3.11 As discussed further below, there is considerable uncertainty over consumers' demand for services that may use digital dividend spectrum. We have therefore considered a range of different demand scenarios and focus in this annex on three specific demand scenarios.

A3.12 For each of the three demand scenarios, we consider the interaction with the four policy options that influence the usability of the spectrum for different service types. We therefore consider twelve different spectrum allocation scenarios and valuations.

A3.13 In the rest of this annex, we discuss the various aspects of the modelling in more detail. We cover:

- our approach to assessing what demand scenarios to model;
- usability of the digital dividend spectrum for each potential service;
- timing assumptions;
- spectrum allocations resulting from the assumptions about supply and demand for digital dividend spectrum;
- other key modelling assumptions;
- DTT service model;
- mobile communications service model;
- MMS model;
- treatment of delay; and
- results from the modelling.

Approach in assessing what demand scenarios to model

A3.14 There is considerable uncertainty attached to the future economic value of the spectrum. There are three main sources of uncertainty:

- **General economic uncertainty:** The effects of the recent global economic upheavals, and the severity and duration of a downturn in the UK economy, are very difficult to predict. While the spectrum released by DSO will remain of

[55] We use the term 'mobile communications' in a generic way, to refer to two-way voice and data services offered over cellular networks.

significant economic value in the period after 2012, the impacts on consumers' and citizens' values for specific applications (and hence bidders valuations at auction) are correspondingly difficult to estimate. This uncertainty is likely to persist regardless of the exact timing of the auction.

- **Uncertainty within specific communications markets:** While the general economic climate will overshadow demand, there is additional uncertainty in specific markets. For example, the market for MMS is still in its infancy, with a variety of business models using a variety of technologies still under development. There is a wide range of projections for the future evolution of mobile communications services following recent explosive growth. The speed of take-up of HD services on the DTT platform and the growth of other TV platforms will affect the DTT platform in the future. There is great uncertainty over how the different methods of delivering "TV content" will act as substitutes and complements. This interrelationship is difficult to model explicitly but has been taken into account when assessing the plausibility of different scenarios; and

- **Technology uncertainty:** The rapid growth in the scope and diversity of mobile communications devices is spurring rapid further development of new standards and capabilities in the industry, including next generation mobile technologies such as LTE (capable of faster access to the internet at speeds comparable to fast fixed-line DSL broadband). However, standards for LTE at 800 MHz have yet to be developed. Their future adoption and use remains uncertain. In some mobile markets there are also benefits in the harmonised use of technologies across national borders, but there remains some uncertainty over the extent to which UHF spectrum that has historically been used for broadcasting will in practice be fully harmonised in Europe.

A3.15 We have therefore sought to capture a wide range of underlying demand assumptions within our demand scenarios. We expect this wide range to capture the plausible range, but we have not attempted to model the absolute lowest or highest value possible for each service. Previous models attempted to provide a conservative estimate of the economic value of the digital dividend spectrum, and we believe the current approach is broadly consistent with this aim.

A3.16 The first two demand scenarios capture what we consider the most plausible outcomes:

- **Scenario 1 - Strong demand for mobile communications** – this scenario involves strong consumer demand for mobile communications and low demand for other services; and

- **Scenario 2 - Strong demand for all services** – this scenario involves strong demand for the spectrum for all of mobile communications, DTT and MMS.

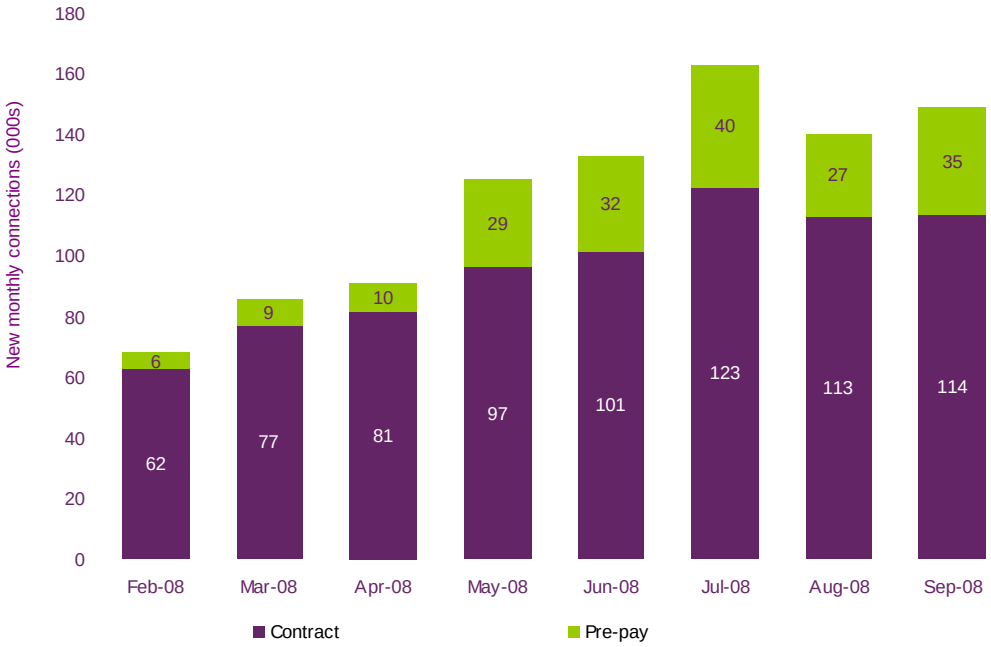
A3.17 We have also considered less likely demand scenarios. In particular, we consider the following scenario:

- **Scenario 3 - Strong demand for DTT only** – this scenario envisages strong demand for DTT and relatively weak demand for mobile communications and MMS.

A3.18 For each of these demand scenarios, we have made detailed assumptions in the individual service models that specify in more detail how we interpret them[56]. We discuss these more detailed assumptions in the sections describing each of the individual service models.

A3.19 One reason we regard Scenario 3 as less likely is that it assumes weaker demand for mobile communications. This is in contrast to recent evidence of strong growth in demand for mobile broadband. We have reported on the increased demand through dongles in a number of recent publications[57]. Figure A3 illustrates this trend by showing the strong growth in new mobile broadband connections.

Figure A3. New consumer mobile broadband connections



Source: GfK retail data.

A3.20 Our most recent research finds that around 9% of households claim to have a mobile broadband connection. This is equivalent to over 2 million connections.

Usability of digital dividend spectrum for each service use

A3.21 Each of the four policy options affects both:

- the most efficient outcome from renegotiating GE06 that will be required; and
- the availability of spectrum in the cleared award.

A3.22 As set out in annex 2 and shown in table A3, we make a number of assumptions about the outcome of the GE06 renegotiation for the four policy options.

[56] A service model takes the inputs specified in paragraph A3.5 to A3.7 and estimates the incremental economic value that one particular potential service derives from using digital dividend spectrum.
[57] See section 5.1.5 of Ofcom, "The Communications Market 2008" (www.ofcom.org.uk/research/cm/ cmr08/cmr08_2.pdf) and section 3.99 of Ofcom, "Mobile citizens, mobile consumers" (www.ofcom.org.uk/consult/condocs/msa08/msa.pdf).

Table A3. International negotiation outcomes assumed

Policy option	International negotiation outcome assumed
A – base case	Minimal renegotiation to GE06
B, C, D – clearing some or all of 61,62 and 69	GE06 renegotiated to allow mobile use of upper band

A3.23 Tables A4 and A5 below outline the maximum possible spectrum in the cleared award that could technically be deployed for DTT and mobile communications (using FDD technologies) under each of the four policy options.[58] This does not mean that we have assumed the spectrum will be used in this way. That will also be affected by the relative demand for the spectrum from the different services. We do not include MMS in this table, because we assume there is no significant variation in the spectrum usabile for MMS between policy options.

Table A4. Maximum spectrum availability for DTT

Policy option	Effect on DTT		
	Lower band	Upper band	Potential services deployed
A	High power use permitted	High power use permitted	Up to 2 multiplexes with over 90% household coverage in-group
B, C, D	High power use permitted	High power use limited to areas far away from coastal regions	Up to 2 multiplexes with over 90% household coverage out of group

A3.24 As explained in the later section on the mobile communications model we have modelled deployment of mobile communications services using FDD technologies in the upper band. Our modelling and feedback from previous consultations suggests that use of FDD in the lower band is less likely than in the upper band. Given these assumptions, table A5 shows the maximum mobile communications spectrum using FDD technology available for each policy option.

Table A5. Maximum spectrum availability for paired FDD mobile communications (in MHz, excluding interleaved)

Policy option	Unharmonised upper band	Harmonised upper band
A	**30**	**0**
B	**30**	**40**
C	**30**	**20**
D	**60**	**60**

Timing Assumptions

A3.25 We modelled each of the services on an annual basis for simplicity. Modelling services on any time period less than a year was expected to add complexity while providing little extra information, given the inherent uncertainty in the services being modelled. Where appropriate a simple adjustment was made to annual values as discussed in the treatment of delay section.

[58] Operators may choose to supplement cleared award spectrum with additional new or existing spectrum holdings.

A3.26 We have assumed spectrum is always used from the beginning of a calendar year. The timing assumptions on this basis we have made for both the award and when the spectrum is usable are shown in table A6 below

Table A6. Effect of policy options on timing assumptions

Policy option	Award date	Earliest use of channel 36	UK-wide use of lower band	UK-wide use of channels 61-62	UK-wide use of channels 63-68	UK-wide use of channel 69
A	**Q2 2010**	**2011**	**2013**	**2013**	**2013**	**N/A**
B	**Q4 2010**	**2012**	**2013**	**2014**	**2013**	**N/A**
C	**Q4 2010**	**2012**	**2013**	**2014**	**2013**	**2013**
D	**Q4 2010**	**2012**	**2013**	**2014**	**2013**	**2013**

A3.27 Spectrum availability affects the time at which consumers may start using mobile communications networks. However, some of the network can be built (and in some cases tested) before the spectrum is available for use. This means that some of the cost savings from using low frequency spectrum accrue during the period when the network is being built but is not in use. We have assumed that spectrum availability does affect the time at which MMS and DTT services are available. We discuss the reasons for this in the treatment of delay section.

Spectrum allocations

A3.28 For each combination of demand scenario and policy option, we have developed assumptions about the allocation of spectrum that may result from the cleared spectrum award. Other possible outcomes might reasonably be assumed. However, we consider our set of assumptions on spectrum allocation to be plausible outcomes. We have checked our assumed spectrum allocations to ensure that they are consistent with the values resulting from the individual service models. However, other auction outcomes are possible and our assumptions are in no sense our preferred outcome.

A3.29 Below we set out our assumptions about the allocation of spectrum. For each of the three demand scenarios we set out the assumptions we have made for the four policy options.

Scenario 1 – Strong demand for mobile communications

A3.30 When there is strong consumer demand for mobile communications and relatively weak demand for other services, we assume spectrum allocations that have the following features:

- There is sufficient demand for DTT services such that operators deploy only two additional commercial multiplexes that rely only minimally on interleaved spectrum. There is insufficient demand for a third commercial multiplex using interleaved spectrum.

- Demand for mobile communications is strong enough that we assume unharmonised use of the upper band, but harmonised use of spectrum occurs when we clear channels 61-69. We assume that other operators are able to afford to deploy networks at higher frequency if there is insufficient 800 MHz spectrum, albeit at a higher cost.

- Demand for mobile TV may be strong, but this can be met through users watching TV using different methods (via the BBC iPlayer etc) so a dedicated network is assumed not to be deployed.

A3.31 Figure A4 shows the assumed band plans for the different policy options.

Figure A4. Assumed band plans for different policy options with demand scenario 1

	31	32	33	34	35	36	37	38	39	40
Option A (base case)	DTT							low power	DTT	
Option B (clear 61 & 62)	DTT							low power	DTT (int.)	
Option C (clear 69)	DTT							PMSE	DTT	
Option D (clear all)	DTT							PMSE	DTT (int.)	

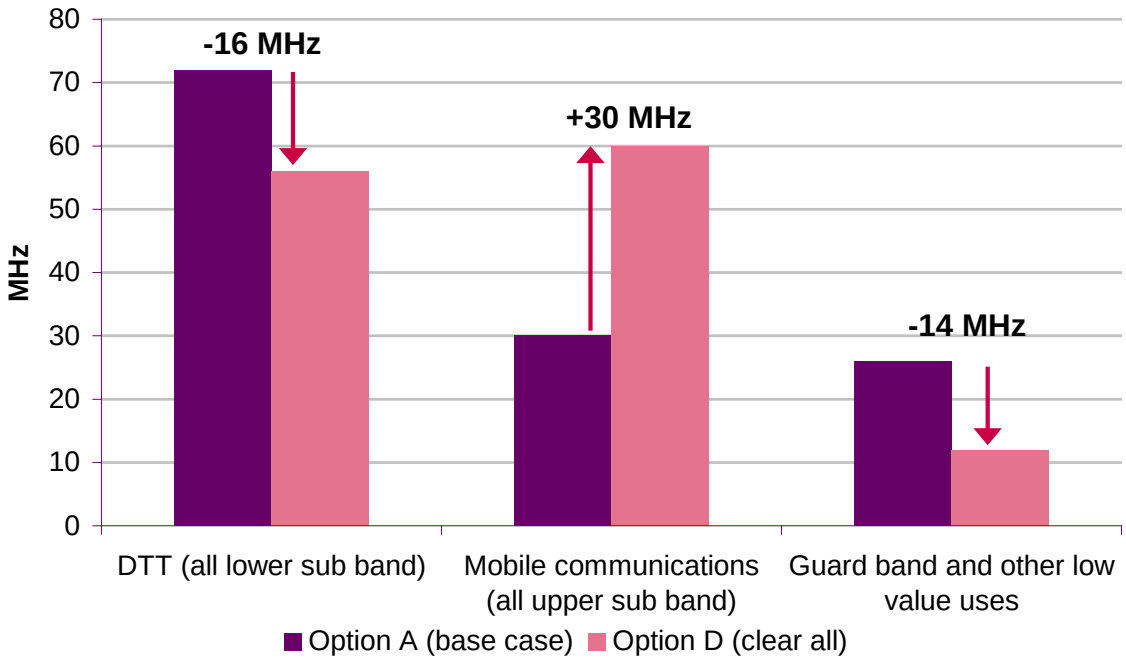
	61	62	63	64	65	66	67	68	69
Option A (base case)	DTT (int.)	G.b.	Mob (int)	Mob. (unharmonised use)	Guard band	Mob. (int)	Mob. (unharmonised use)	G. b.	PMSE
Option B (clear 61 & 62)	Mob. (high value)			Mob. (low value)	Guard band		Mob. (high value)	G. b	PMSE
Option C (clear 69)	Mob. (low value)			Mob. (high value)	Guard band		Mob. (low value)		Mob. (high value)
Option D (clear all)	Mob. (high value)				Guard band		Mob. (high value)		

DTT (int): Spectrum that is shared with the operators of the existing six multiplexes and used for new DTT services
Mob: Spectrum for mobile communications services
Mob (int): Unharmonised interleaved spectrum
Mob (High value): Harmonised spectrum subject to no constraints
Mob (Low value): Harmonised spectrum subject to some constraints

A3.32 In our modelling, we have drawn finer distinctions than are illustrated in the band plan above. For example, we have made more distinctions between different types of mobile communications deployment than shown in the band plans.

A3.33 Another way of showing the impact of the policy options on the different services is to consider the amount of nationally available spectrum assumed for different services. Figure A5 compares the outcomes for policy option A and policy option D for demand scenario 1, excluding interleaved and PMSE spectrum.

Figure A5. Changes in spectrum use with demand scenario 1 (excl. interleaved & PMSE)



A3.34 Clearing all three channels results in a significant increase of 30 MHz in the amount of spectrum used for mobile communications (excluding interleaved spectrum). In

this scenario the value of unharmonised spectrum to mobile communications is sufficient for unharmonised deployment to occur in policy option A. There is also a smaller (16 MHz) reduction in the use of spectrum for DTT.

Scenario 2 – Strong demand for all services

A3.35 When there is strong demand for the spectrum for all of mobile communications, DTT and MMS, we assume spectrum allocations that have the following features:

- There is sufficient demand for DTT services that up to two additional multiplexes may be deployed using largely cleared spectrum, although one of the multiplexes may require some interleaved spectrum. There is sufficient demand for DTT services such that a third additional multiplex may be deployed using interleaved spectrum. The number of multiplexes actually deployed may be less than this (or may have limited coverage) if MMS demand is strong enough to use up significant amounts of lower band spectrum.

- The demand for mobile communications is similar to scenario 1 above.

- Demand for stand-alone mobile TV services is strong enough that dedicated networks are required, as other networks cannot provide the quality or quantity of data that users would demand at the same price.

A3.36 Figure A6 shows the assumed band plans for the different policy options.

Figure A6. Assumed band plans for different policy options with demand scenario 2

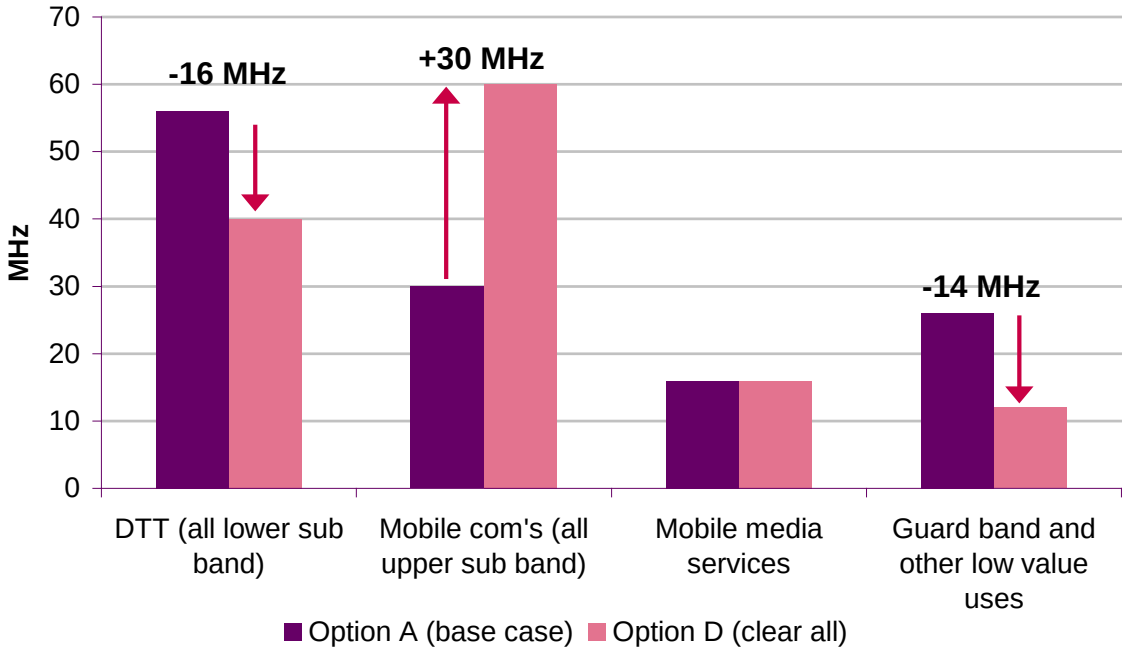
	31	32	33	34	35	36	37	38	39	40
Option A (base case)	DTT					Mobile multimedia services		low power	DTT	
Option B (clear 61 & 62)	DTT					Mobile multimedia services		low power	DTT (int.)	
Option C (clear 69)	DTT					Mobile multimedia services		PMSE	DTT	
Option D (clear all)	DTT					Mobile multimedia services		PMSE	DTT (int.)	

	61	62	63	64	65	66	67	68	69
Option A (base case)	DTT (int.)	G.b.	Mob (int)	Mob. (unharmonised use)	Guard band	Mob. (int)	Mob. (unharmonised use)	G. b.	PMSE
Option B (clear 61 & 62)	Mob. (high value)			Mob. (low value)	Guard band	Mob. (high value)		G.b.	PMSE
Option C (clear 69)	Mob. (low value)			Mob. (high value)	Guard band	Mob. (low value)			Mob. (high value)
Option D (clear all)	Mob. (high value)				Guard band	Mob. (high value)			

DTT (int): Spectrum that is shared with the operators of the existing six multiplexes and used for new DTT services
Mob: Spectrum for mobile communications services
Mob (int): Unharmonised interleaved spectrum
Mob (High value): Harmonised spectrum subject to no constraints
Mob (Low value): Harmonised spectrum subject to some constraints

A3.37 Figure A7 compares the outcomes for policy option A and policy option D for demand scenario 2.

Figure A7. Changes in spectrum use with demand scenario 2 (excl. interleaved & PMSE)



A3.38 In this demand scenario, MMS secures two channels (16 MHz) in the lower band in both policy options. In policy option D, when all the three channels are cleared, mobile communications secures 30 MHz more spectrum in the upper band. DTT again loses 16 MHz in this scenario.

Scenario 3 – Strong demand for DTT only

A3.39 When there is strong demand for DTT and relatively weak demand for mobile communications and MMS, we assume spectrum allocations have the following features:

- There is sufficient demand for DTT such that two additional commercial multiplexes would be rolled out using cleared spectrum, although multiplexes may rely on some interleaved spectrum, with a third commercial multiplex deployed using interleaved spectrum.
- Demand levels for mobile communications are lower so if operators had access to 800 MHz spectrum they would roll out a limited number of sites. As a result, unharmonised use of the upper band is not economically efficient or commercially viable, so does not occur in policy option A (the base case). In policy option D, when we clear channels 61, 62 and 69, the use of upper band spectrum for mobile communications is both economically efficient and commercially viable.
- demand for MMS services is lower, such that it is not profitable for firms to roll out any dedicated MMS networks using digital dividend spectrum.

A3.40 Figure A8 shows the assumed band plans for the different policy options.

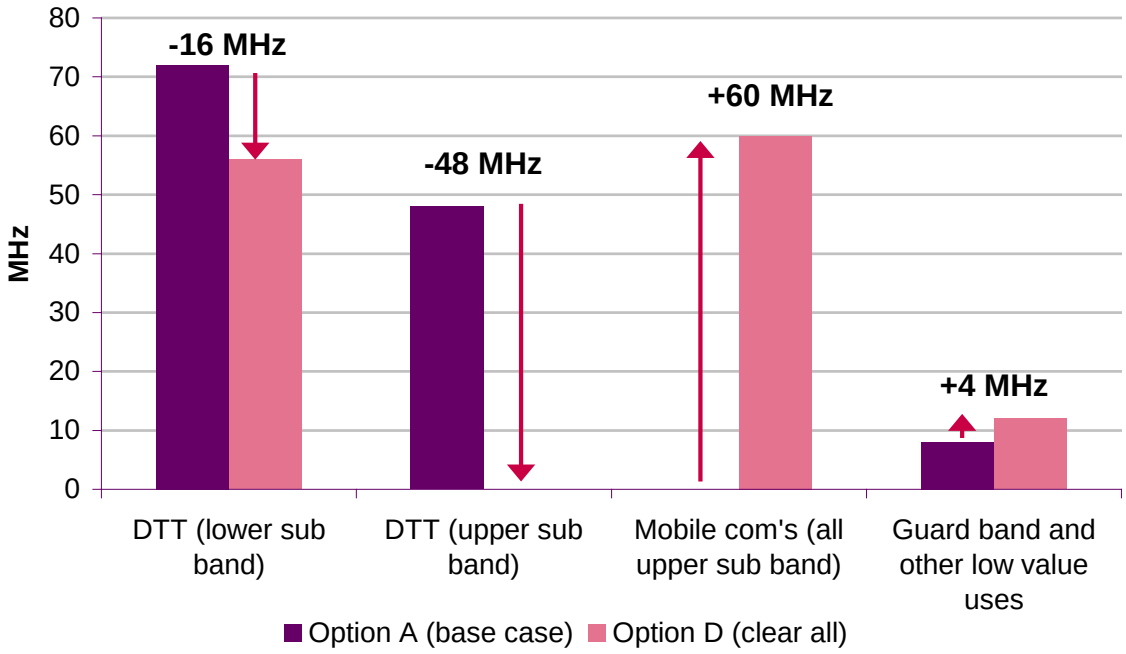
Figure A8. Assumed band plans for different policy options with demand scenario 3

	31	32	33	34	35	36	37	38	39	40
Option A (base case)	DTT							low power	DTT	
Option B (clear 61 & 62)	DTT							low power	DTT (int.)	
Option C (clear 69)	DTT							PMSE	DTT	
Option D (clear all)	DTT							PMSE	DTT (int.)	

	61	62	63	64	65	66	67	68	69
Option A (base case)	DTT (int.)		DTT						PMSE
Option B (clear 61 & 62)	Mob. (high value)		Mob. (low value)		Guard band	Mob. (high value)		G.b.	PMSE
Option C (clear 69)	Mob. (low value)		Mob. (high value)		Guard band	Mob. (low value)			Mob. (high value)
Option D (clear all)	Mob. (high value)				Guard band	Mob. (high value)			

A3.41 Figure A9 compares the outcomes for policy option A and policy option D for demand scenario 3.

Figure A9. Changes in spectrum use with demand scenario 3 (excl. interleaved & PMSE)



A3.42 In scenario 3, mobile communications does not secure any spectrum when we do not clear 61, 62, or 69. DTT secures all of the available spectrum in the upper and lower bands. In contrast, when all three channels are cleared, mobile communications has 60 MHz, most of the upper band. By renegotiating GE06, there will be more restrictions on DTT use of the upper band whilst there will be less restrictions on mobile communications use of the same spectrum

A3.43 For the reasons set out above (see paragraph A3.19), Scenario 3 is a less likely scenario than the other scenarios considered here. We have included this scenario for completeness but we consider it unlikely, for the reasons given earlier.

Other key modelling assumptions

Guard bands and auction design assumptions

A3.44 In developing our assumed band plans, we have assumed guard bands that are consistent with the cleared award consultation document[59] with one exception. This is that we assume there is no guard band between MMS and new DTT. We are

[59] www.ofcom.org.uk/consult/condocs/clearedaward/condoc.pdf.

undertaking ongoing work to assess the way in which existing DTT services will be protected from interference. We have assumed that although there may be an initial 5 MHz guard band between MMS and new DTT services, secondary trading allows DTT use adjacent to MMS to occur where this is technically feasible and sufficiently commercially attractive. The loss in coverage for a new DTT service would be of the order of 1-2% with no guard band. We have assumed that in scenarios where there is high demand for the upper and lower bands, it is unlikely that MMS and DTT operators would leave the guard band unused.

A3.45 Additionally we have assumed:

- **No aggregation or threshold risks in the auction.** Some of the band plans assume that significant amounts of interleaved spectrum are required to increase the coverage of DTT multiplexes. We assume that multiplex operators would be able to acquire this after the cleared award auction.

- **Renegotiation of GE06 does not materially affect the amount of interleaved spectrum.** Renegotiation of GE06 in all policy options will necessarily affect the specific frequencies and usability of interleaved spectrum. We have assumed that this will not be a large net effect between policy options in aggregate.

Discounting and related assumptions

A3.46 In all our modelling, we have used:

- The Treasury's social discount rate of 3.5% to discount costs and benefits.

- A time period from 2009 to 2026 in considering costs and benefits. The end date of 2026 was chosen as this aligns the end date of existing and potential new DTT services. Services may have economic value beyond this end-date, but the proposed initial licences are for this duration. This assumption may prove to be unrealistic but provides a conservative estimate of the benefit.

- All results shown as present values in 2009 pounds sterling.

Economic values not indication of auction proceeds

A3.47 The economic values quoted are not an indication of auction proceeds. This is for a variety of reasons, including the following:

- the private producer and consumer value includes all value generated for both producers and consumers and not just the value which auction bidders might be able to realise;

- the producer value we have modelled is the total producer value, rather than the producer value generated by the potential bidder alone;

- the producer value generated by a potential bidder is the maximum they should be willing to bid in an auction. The design and rules of the auction and market circumstances at the time of the award will determine the amount a bidder will have to pay (i.e. auction proceeds). Auction proceeds may be only a proportion of the producer value of the winning bidder; and

- as noted above, real future values have been discounted at 3.5% and private sector bidders will discount future values at their own opportunity costs of capital.

Services not modelled

A3.48 There are a number of services (that have been modelled in previous DDR work) have not been modelled explicitly for the purposes of this consultation. In particular, we have not modelled PMSE and local TV.

A3.49 As discussed in section 5, we expect that the usability of spectrum made available for PMSE use will be similar between the alternative policy options.

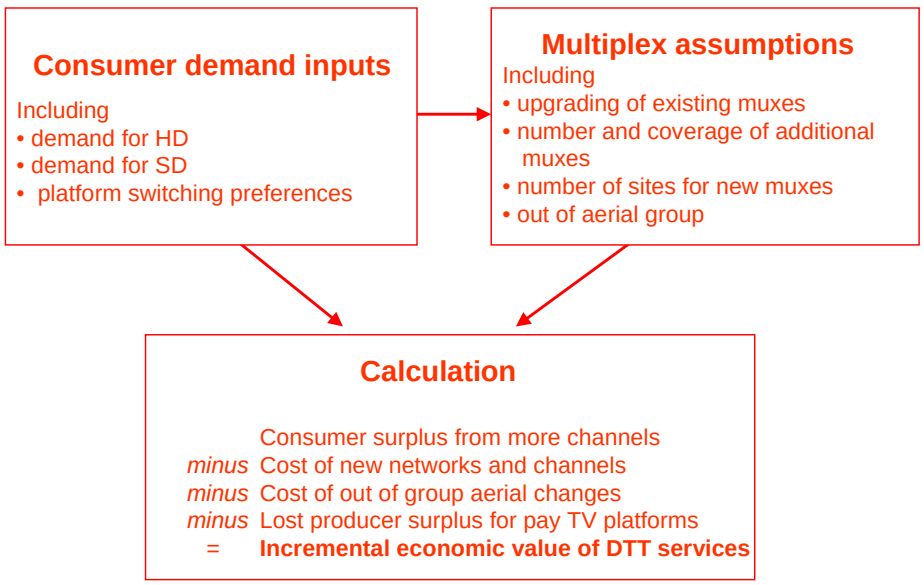
A3.50 The total value of local TV is dependent on the amount and usability of interleaved spectrum that is available. There may be changes between policy options in the amount of spectrum in individual areas, but we do not expect the net effect between policy options to be significant in aggregate.

A3.51 We have not explicitly modelled low power use in channel 38, as the economic benefit of using this channel for other uses is likely to be low relative to the size of the benefits of our preferred policy option.

DTT model

A3.52 Figure A10 below gives an overview of our approach to modelling the economic value from DTT services using the digital dividend cleared spectrum. We make assumptions about consumers' tastes for Standard Definition (SD) and High Definition (HD) television. Partly informed by these, we make assumptions about the technologies used and on existing and future multiplexes and the way in which future multiplexes will be deployed. We then estimates the incremental value that DTT viewers would derive from new DTT multiplexes, less various costs, such as the costs of building new networks and the ongoing running costs of the channels on them.

Figure A10: Outline of DTT Model structure



A3.53 The key inputs that affect the incremental value of the use of digital dividend spectrum for DTT are:

- **Demand for HD**. This has two components:
  - How widespread is the desire for HD. We assume that between around 30% and 60% of homes obtain material value from watching HD content.
  - How much HD-equipped consumers value content in HD over SD. We assume that when consumers watch HD content, they value it around 20-30% more than somebody who watches it in SD. We have used a slightly more aggressive range than in the future of DTT consultation, which used a range of 15-25%[60].
- **Demand for SD**. This also has two components:
  - level of interest in a high number of SD channels; and
  - how much viewers who have HD sets value watching channels that are exclusively in SD.
- How many existing multiplexes are upgraded to DVB-T2/MPEG4. This is relevant because it affects the future capacity of the existing multiplexes and hence the economic value of new multiplexes. We have incorporated the policy decision to enable the upgrade of Multiplex B to DVB-T2/MPEG4.[61]
- Whether new multiplexes are in SD or HD. The value that consumers place on channels provided via the new multiplexes will depend if they are broadcasting HD or SD channels.
- **The coverage of new multiplexes**. The coverage of new multiplexes depends on:
  - the amount of cleared and interleaved spectrum used for each multiplex; and
  - the international interference environment. Initial studies suggest that under policy options B, C and D a multiplex using three channels may have up to 90% of households covered. Previous analysis suggested that in policy option A, coverage of 90% of homes may require at least four UHF channels.
- The **amount of interleaved spectrum needed to supplement coverage using cleared channels**. In certain circumstances, multiplexes using cleared channels may wish to add in interleaved spectrum either to provide in-group coverage or to boost coverage. We assume that each of the policy options does not affect the overall demand for interleaved spectrum, but may affect the resulting coverage of the seventh and eighth multiplexes.

[60] The objective of the future of DTT consultation was to find a conservative value in intervening to upgrade multiplex B. In this consultation, we wish to make a conservative estimate of the alternative policy options and hence we have erred to slightly increase the value of digital dividend spectrum to DTT.
[61] www.ofcom.org.uk/consult/condocs/dttfuture/dttfuture.pdf.

A3.54 Our assumptions about the number of DTT multiplexes required to serve consumer demand change as we move through scenarios 1 to 3. This is to reflect an assumed increase in demand for SD and HD services. We assume:

- **Scenario 1**. Consumer interest in watching DTT is relatively weak. For example the proportion of homes interested in watching services in HD reaches around 30% by 2020, and they have a 15% increase in value from watching services in HD. Consumer interest in additional SD channels is such that only one existing multiplex has upgraded to DVB-T2/MPEG 4.

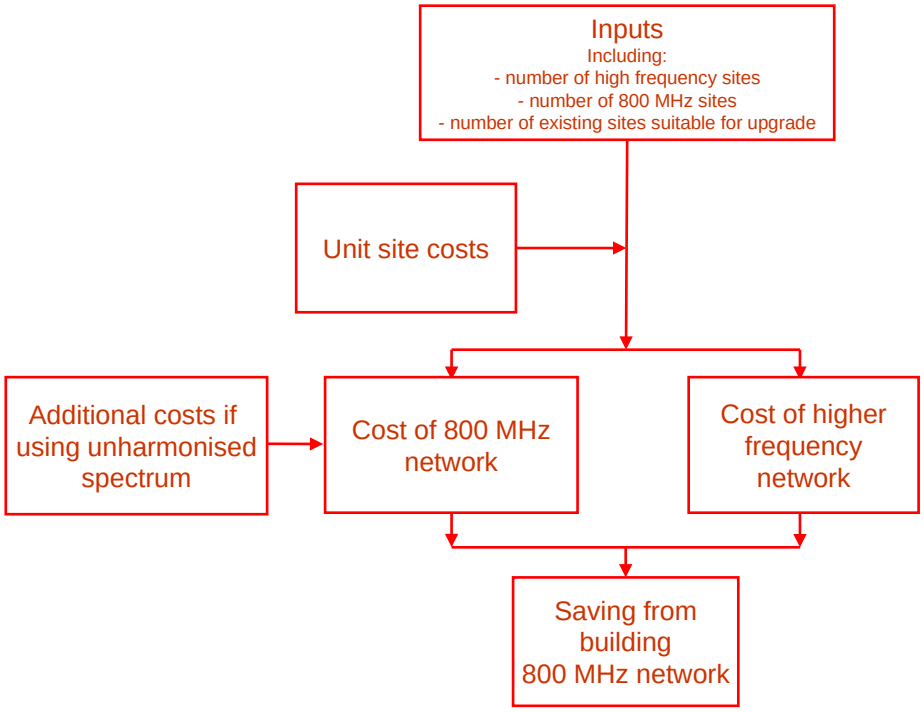
- **Scenario 2** Consumer interest in watching DTT is stronger than in scenario 1. For example, the proportion of homes interested in watching services in HD is around 60%, and they have a 30% increase in value from watching services in HD by 2020. Homes that watch channels in HD still enjoying watching SD channels so that by 2020 up to three existing multiplexes have upgraded to DVB-T2/MPEG 4.

- **Scenario 3** As per scenario 2, but consumer interest in additional SD channels is assumed higher than in scenario 2.

Mobile communications model

A3.55 We have modelled the economic value from mobile communications by comparing the cost of rolling out a network using the 800 MHz spectrum with the cost of doing so at a higher frequency. Figure A11 gives an overview of the approach. The costs are lower with 800 MHz spectrum because fewer transmission sites are required at lower frequency to deliver the same service.

Figure A11. Outline of mobile communications model structure



A3.56 There is considerable uncertainty around which technologies operators will use to deploy future mobile communication services. It is not clear if operators will use TDD (such as WiMAX) or FDD (such as LTE or HSDPA) technologies.

A3.57 We have chosen to model the use of LTE technology. We have not done this because we favour that technology over another, but because LTE in the 800 MHz band is a plausible candidate given that some of its standards are being developed. The beneficial propagation characteristics of digital dividend cleared spectrum would also apply to other mobile communications technologies such as WiMAX. If we had modelled another technology, we anticipate that it would also have shown significant savings from using 800 MHz spectrum relative to using other higher frequency spectrum.

A3.58 As the alternative higher frequency, we used 1800 MHz. If we had compared 800 MHz with 2.6 GHz, we expect the frequency benefit of 800 MHz (and hence cost difference) would have been larger. We assume that the propagation characteristics of 2100 MHz spectrum would be similar to 800 MHz spectrum. We note that not all operators will have access to 1800 MHz spectrum or other high frequency band, but that this approach offers a conservative estimate of value difference.

A3.59 We undertook some limited modelling of LTE-type services in order to understand the relationship between site numbers using 2 x 10 MHz for an 800 MHz network and those using 2 x 10 MHz for an 1800 MHz network[62.] The modelling made assumptions that were broadly consistent with the approach taken in our considerations of liberalisation of mobile spectrum. In the absence of definitive standards for LTE in 800 MHz, we adopted what we consider to be reasonable assumptions based on standards for other bands.

A3.60 Our modelling suggested that for reasonable technical and service parameters the ratio of sites with 1800 MHz compared to 800 MHz was between 2 and 3.7.[63] Greater indoor coverage or peak data rate would tend to result in the ratio being at the higher end of this range. However, if the number of sites at 1800 MHz is very high then it may be too expensive or impractical[64] to deploy an LTE network at this frequency. In these cases, the absolute size of the cost advantage of 800 MHz is unlikely to be a good indicator of its economic value and instead the impact of potential quality differences would need to be considered in a full evaluation. We have not modelled 1800 MHz networks that require very high numbers of sites.

A3.61 Other inputs that have a significant impact on the economic value of mobile communications include:

- **The consumer demand for mobile communications.** If operators choose to offer services provided with 800 MHz spectrum to a limited coverage area, then the absolute cost advantage that 800 MHz spectrum provides will be lower.

- **The cost of using unharmonised spectrum.** As discussed in section 3, there are costs to FDD operators in using spectrum that is not harmonised with the rest of Europe. This therefore represents a further cost advantage to using harmonised 800 MHz spectrum.

A3.62 The assumptions in each of the three demand scenarios as are follows:

[62] "1800 MHz band" means the 1710-1785 MHz and 1805-1880 MHz bands
[63] This result is similar to the results obtained for existing technologies.
[64] Our timeframe of assessment in this statement is longer than in our mobile liberalisation statement, and we have therefore used a slightly different limit when looking at the practicality of network deployments.

- **Scenario 1**. The cost of using unharmonised 800 MHz spectrum is high, but deployment is assumed given the high demand. Up to three existing operators are assumed to obtain spectrum in the 800 MHz band. The 800 MHz network is able to provide a service that can offer either:
    - peak data rates higher than that which could be provided using HSDPA; and/or
    - data volumes that could not be easily supported using HSDPA technology.
- **Scenario 2**. As per scenario 1
- **Scenario 3**. LTE networks are rolled out that can offer both the same capacity and peak data rates as HSDPA networks. LTE technology is not used to its full potential, and operators use the spectrum to supplement existing networks. Operators using either low- or high-frequency spectrum roll out a smaller network.

A3.63 In this assessment we have made no explicit assumption regarding:

- the total amount of spectrum in the 900 MHz[65] band that is usable for next generation mobile;
- how much spectrum each operator holds in the 900 MHz band;
- which operators win access to the 800 MHz band; or
- how much spectrum each operator holds in the 1800 MHz, 2100 MHz and 2.6 GHz bands.

A3.64 The cost differences are supposed to be illustrative rather than specify a plausible or preferred outcome.

A3.65 We have not attempted to model the commercial incentives of specific potential operators. We have done this for three reasons:

- It is not appropriate to assume the outcome of liberalising the 900 MHz band. Our assumption that up to three operators require 2 x 10 MHz using sub-1 GHz is consistent with a range of outcomes such as:
    - a scenario where there is very heavy use of 900 MHz for 3G and GSM so that it is difficult for incumbent operators to clear this spectrum;
    - a scenario where in the long term at least 2 x 10 MHz of contiguous sub 1 GHz spectrum is required; or
    - LTE technology in the 900 MHz band is not available on a similar timescale to the 800 MHz band.

[65] "900 MHz band" means the 880-915 MHz and 925-960 MHz bands.

- Existing mobile communications operators have different legacy amounts of spectrum and may have different demand for 2.6 GHz and 800 MHz spectrum.

- Existing and new operators will have different business models and may wish to offer different services.

A3.66 We have not modelled the value of a new firm entering the mobile communications market. We have done this for the following reasons:

- it is not clear what spectrum requirements, and other network investments a new firm would require in order to be able to be able to compete in the mobile communications market;

- this would also require us to assume the outcome of the 2.6 GHz auction; and

- new firms would have no existing networks to upgrade and may place a high value on new or additional spectrum.

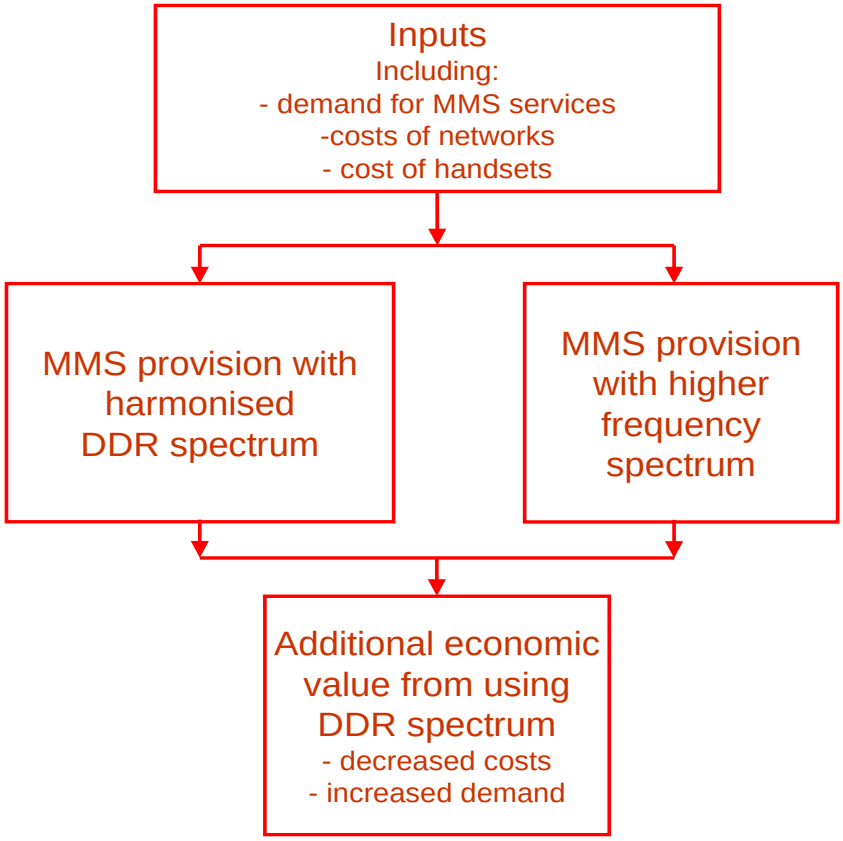
A3.67 Modelling a new firm could have given an aggressive valuation of digital dividend spectrum for mobile communications use.

MMS services model

A3.68 We have modelled the economic value from MMS services by estimating the additional economic value that a dedicated national service using digital dividend spectrum could provide relative to provision using higher frequency spectrum. We use the term MMS services to refer to services that are provided on dedicated broadcast-type networks.

A3.69 Figure A12 below gives an overview of the model structure.

Figure A12. Outline of MMS model structure



A3.70 There are two aspects of potential additional economic value that may result from using digital dividend spectrum to provide MMS services, compared to other potential spectrum bands:

- Decreased costs:
  - an EU-wide frequency standard has been agreed for MMS to operate in UHF spectrum (using DVB-H technology). If the UK uses EU-wide harmonised spectrum, the costs of handsets is assumed to be lower as development costs are spread across the entire EU rather than just the UK market; and
  - a smaller number of sites would be needed with the digital dividend spectrum compared to using higher frequency spectrum
- Increased demand, because of better reception capabilities, and due to likely wider variety of handsets if harmonised spectrum is used.

A3.71 For the higher frequency, we assume the MMS services are provided with L-Band spectrum.

A3.72 The assumptions in each of the demand scenarios are as follows:

- **Scenario 1**: demand for mobile TV is not sufficient to support any dedicated MMS networks in digital dividend spectrum.
- **Scenario 2:** there are two MMS networks in the lower band, each using one 8 MHz channel. Consumers place a value on the specific qualities of UHF

spectrum, and enjoy cheaper handsets because of European-wide development. One of the channels we assume is used is channel 36. We assumed MMS use in this channel is subject to protecting channel five's analogue core network in the transition period before DSO is completed.

- **Scenario 3:** demand for mobile TV is not sufficient to support any dedicated MMS networks in digital dividend spectrum.

A3.73 In two of the demand scenarios, we therefore assume there is no dedicated MMS network in digital dividend spectrum. In part, this is because since the last consultation the options for mobile TV services that do not require the use of MMS have broadened. For example, three existing mobile phone operators already offer mobile TV over 3G networks.

Treatment of delay

A3.74 For each of the different service uses we have treated the cost of delay in a slightly different fashion. The assumptions for each potential service are set out below.

A3.75 **DTT** - The lower band is assumed available from 1st Jan 2013 in all scenarios. When operators win channel 36 at auction we assume it is not used in any significant fashion before DSO. In policy options B, C, and D, we assume DTT does not win any upper band spectrum in any of the demand scenarios. Delay to the availability of upper-band spectrum does not result in delay to the rollout of DTT services. We have assumed that renegotiations for GE06 in the lower band do not take so long as to push the date of the auction so far as to jeopardise the planning and building of new DTT networks. We do not assume that any operator would use cleared spectrum pre-DSO.

A3.76 **Mobile communications** – A delay in spectrum usability will only have a significant impact on the cost advantage of 800 MHz spectrum if it changes the pace of rollout of the network. We expect that operators may build part of the network before the spectrum is cleared for use so that a degree of network testing can occur. We expect that there will not be widespread existence of LTE 800 handsets before 2013. We assume that the delay in the usability of some spectrum from 2013 to 2014 does not have a significant impact on the cost of building the network. However, a delay in the usability of spectrum until 2015 could have a significant impact on the cost advantage of 800 MHz spectrum as spectrum availability may well be the limiting factor in determining the rollout profile of the network. As discussed in annex 2, delay to the usability of the spectrum until 2015 is considered unlikely, but we have assessed this as a sensitivity in paragraphs A3.84 to A8.87 below.

A3.77 **MMS** - We assume that MMS can be deployed in channel 36 as soon as is practical after the auction and that MMS in all other channels cannot commence until after DSO. For modelling purposes we have assumed that a network in channel 36 is fully operational by 2011 and in all other channels by 2013. This would require very rapid rollout for an operator that is using channel 36. We modelled MMS services on an annual basis so to obtain the cost of a six month delay to the use of channel 36 for MMS services we halved the cost of a full year's delay. This is likely to overstate the cost of delay.

Results

A3.78 Table A7 shows the incremental value for each service, for each demand scenario and policy option.

A3.79 We also include the costs of clearing the channels, to give the net economic benefit of the different policy options. The size of the implementation costs is largely independent of the underlying demand assumptions of scenarios 1, 2 and 3. We have assumed low implementation costs in scenario 1 and high implementation costs in scenario 2 to obtain a low to high range for the most likely outcomes. Scenario 3, which we see as a less likely scenario, also assumes high implementation costs.

A3.80 The implementation costs of clearing channels 61-62 and 69 have been revised as a result of comments from stakeholders and further internal analysis. Revisions to the cost of clearing 61-62 are discussed in annex 2, with revisions to the cost of clearing 69 in section 5.

Table A7. Net incremental value per service use (£m)

	Scenario 1	Scenario 2	Scenario 3
Option A: Baseline (i.e. do not clear channels)			
Economic value of DTT	2,100	2,400	3,600
Economic value of Mobile Broadband	1,200	1,200	0
Economic value of MMS	0	1,600	0
Cost of Clearance	0	0	0
Total economic value	**3,300**	**5,200**	**3,600**
Option B: Clear channels 61 and 62 only			
Economic value of DTT	2,000	2,000	3,100
Economic value of Mobile Broadband	3,200	3,200	900
Economic value of MMS	0	1,400	0
Less costs of clearing channels 61 & 62	(100)	(220)	(220)
Total economic value	5,100	6,400	3,800
Option C Clear channel 69 only			
Economic value of DTT	2,100	2,400	2,900
Economic value of Mobile Broadband	2,100	2,100	600
Economic value of MMS	0	1,400	0
Less costs of clearing channel 69	(15)	(30)	(30)
Total economic value	4,100	5,800	3,500
Option D: Clear channels 61, 62 & 69			
Economic value of DTT	2,000	2,000	3,100
Economic value of Mobile Broadband	4,400	4,400	1,300
Economic value of MMS	0	1,400	0
Less costs of clearing channels 61, 62 & 69	(115)	(250)	(250)
Total economic value	6,300	7,500	4,100
Incremental benefit of Option B vs. Option A	1,800	1,200	200
Incremental benefit of Option C vs. Option A	800	700	(100)
Incremental benefit of Option D vs. Option A	**2,900**	**2,400**	**500**

Numbers may not sum due to rounding. We have rounded the value of individual services and the total economic value to the nearest £100m.

A3.81 Table A7 shows that in each of our three scenarios, policy option D always provides the highest net economic value. It is also true that option D provides higher economic value than option B, which provides higher economic value than C.

A3.82 The assumed international renegotiation of GE06 in policy options B, C and D results in a loss of value from potential new DTT services in these policy options. However, when that negotiation has taken place, policy options C, B and D provide increasing amounts of spectrum that can be used by mobile communications. This will be the case unless there is no demand for nationally available 800 MHz spectrum for mobile communications.

A3.83 Of the three demand scenarios, the preferred policy option D offers the smallest incremental benefit in scenario 3. In this scenario, there is no demand by mobile communications for unharmonised use of the upper band. This is because there is relatively low demand for this spectrum as operators cannot afford to sustain unharmonised use of the spectrum. Through clearing channels 61-69, the value of the spectrum to DTT is decreased and the value to mobile communications is raised. This occurs as the spectrum is now more suited to mobile communications use than before.

Sensitivity Analysis

A3.84 The impact of the following sensitivities have been assessed:

- A delay to the usability of the 800 MHz band.

A3.85 The impact of these sensitivities against the preferred policy option is outlined below:

Table A8: Impact of a one year delay to the availability of 800 MHz spectrum

Sensitivity	Demand Scenario	Change to policy option A	Change to policy option D	Change to net benefit (D over A)	Net position of D against A
Delay to Upper Sub Band usability	1	£-	(£400m)	(£400m)	£2.5bn
	2	£-	(£400m)	(£400m)	£2.0bn
	3	£-	(£100m)	(£100m)	£500m

A3.86 A year's delay to the use of the entire sub-band results in 800 MHz networks being deployed one year later than they otherwise would have been, and so the cost advantage of 800 MHz spectrum is reduced.

A3.87 A year's delay to the usability of the entire upper sub band reduces the net benefit of our preferred policy option by up to £400m, but this does not alter our preferred policy option.

Annex 4

Glossary of abbreviations

2G	Second-generation wireless telephone technology
AMPS	Association of Motion Picture Sound
BEIRG	British Entertainment Industry Radio Group
BIG	Broadcast Infrastructure Group
CBA	Cost/benefit analysis
CEPT	European Conference of Postal and Telecommunications Administrations
DDR	Digital Dividend Review
DL	Downlink
DSHS	Digital switchover help scheme
DSO	Digital switchover
DTG	Digital Television Group
DTT	Digital terrestrial television
DVB-H	Digital Video Broadcast – Handheld
DVB-T	Digital Video Broadcast – Terrestrial
ECC	Electronic Communications Committee
EU	European Union
FDD	Frequency-division duplexing
GE06	Geneva 2006
GHz	Gigahertz
H3G	Hutchinson 3G
HD	High definition
HSDPA	High-Speed Downlink Packet Access
IBS	Institute of Broadcast Sound
IMT	International Mobile Telecommunications
ISB	Independent Spectrum Broker

ITU	International Telecommunication Union
ITU-RR	International Telecommunication Union Radio Regulations
JPP	Joint Frequency Planning Project
LTE	Long-Term Evolution
MHz	Megahertz
MMS	Mobile multimedia services
MNO	Mobile network operator
MOU	Memorandum of understanding
mW	Milliwatt
NPV	Net present value
PLASA	Professional Light and Sound Association
PMSE	Programme-making and special events
PSB	Public-service broadcasting
PT1	Project Team on IMT Matters
RRC-06	Regional Radio Conference 2006
SD	Standard definition
SFN	Single-frequency network
TDD	Time-division duplexing
TG4	Task Group 4
TIPG	Technical Infrastructure Planning Group
TLC	Technical licence condition
UHF	Ultra-High Frequency
UL	Uplink
VHF	Very High Frequency
W	Watt
WiMAX	Worldwide Interoperability for Microwave Access
WRC-07	World Radiocommunication Conference 2007