Digital dividend: clearing the 800 MHz band

Consultation responses

Publication date: 9 July 2009

Introduction

1.1 This document contains a summary of responses to our consultation on clearing the 800 MHz band[1] and our comments thereon. On 30 June 2009, we published a statement on the issues raised in the consultation, including where relevant consideration of responses received.[2]

1.2 In commenting on the majority of the responses to the consultation, we cross-refer where appropriate to the statement. Any responses not addressed in the statement are addressed in this document.

1.3 We received 84 responses to the consultation. They were submitted by a range of interested parties. 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
Channel 4 (C4)
Digital UK
Five
S4C
Virgin Media Ltd

Telecommunications sector

BT
Ericsson
GSMA
Hutchison 3G UK Limited (H3G)
Intellect
Motorola Ltd
Nokia UK Ltd
Nortel Networks UK Ltd
Orange UK
Qualcomm
Samsung Electronics UK
Telefónica O2 UK Limited (O2)
T-Mobile
Vodafone
WiMAX Forum

Programme-making and special events (PMSE) sector

Association of Motion Picture Sound
Association of Professional Wireless Production Technology
Audio Technica Ltd
BECTU
Better Sound Ltd

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

Britannia Row Ltd
British Entertainment Industry Radio Group (BEIRG)
Burlington Baptist Church 1
Burlington Baptist Church 2
Butlins Skyline Ltd
Christchurch Baldock
Churches Legislation Advisory Service
Darragh, Michael
Digico UK Ltd
Dimension Audio Ltd
Elliot, Peter
Hall, David
Hawthorn Theatrical Limited
Institute of Broadcast Sound
JFMG
Johnson, Paul
Mactaggert, Neil
Manton, Richard
Milton, Mary
Musicians' Union
Nicol, Howie
Orbital Sound Ltd
Pickering, Adrian
Professional Lighting and Sound Association (PLASA)
Richmond Film Services
Royal National Theatre
RSD
Rugby Football Union
Spectrum for Programme Makers Forum
St John's Church
Wakeman, David
Wigwam Acoustics Limited
Wilson, John
Wilson, Stuart

Other

Burness, Sidney
Cable Europe
Copsey Communications
David Hall Systems Ltd
Isle of Man Communications Commission
Kang, S.
Lamont, Richard
Ofcom Advisory Committee for Northern Ireland (ACNI)
Ofcom Advisory Committee for Scotland
RNID
Virgin Media

Consultation responses

Issue	Our comments
Question 1. The costs and benefits of clearing the 800 MHz band	
Respondents from the telecommunications sector urged us to clear the 800 MHz band as soon as possible after digital switchover (DSO). H3G and T-Mobile argued for clearing channel 69 early and on a regional basis, as per the DSO timetable. They claimed that early clearance would ensure that the spectrum did not remain fallow and that it could facilitate an early regional rollout of mobile broadband services.	It is important to consider the timing of clearing the 800 MHz band from two perspectives. Clearing channels 61 and 62 Our proposals to clear digital terrestrial television (DTT) from channels 61 and 62 are based on the earliest possible date, given our objectives not to disrupt the DSO timetable and to maintain multiplex coverage obligations as far as possible. We have considered on a practical level where we can reasonably integrate clearance of these channels with DSO given the competing demands for highly specialised resources (e.g. frequency planning and engineering), the lead time for ordering equipment and the feasibility of integration. Our view is that the most efficient timetable for clearing DTT from channels 61 and 62 on a UK-wide basis is likely to be the end of 2013. See paragraphs 4.56 to 4.65 in section 4 of the statement for further details. Clearing channel 69 PMSE users will continue to have 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. It may yet be possible for PMSE access to the band to continue up to the end of DSO in late 2012 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. Please refer to paragraph 5.71 of the statement. Providing for an orderly migration for PMSE users from channel 69 remains a key objective to minimise disruption. See paragraphs 5.69-5.71 for further details.
O2 argued we had overstated the benefits of clearing this spectrum, while Vodafone agreed the benefits we had presented were likely to be conservative.	Paragraphs A2.38-A2.45 in the impact assessment set out an explanation of our response to O2's comments on the modelling we undertook.

A number of respondents, although agreeing with our proposal to clear the 800 MHz band, 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.	See paragraph 4.61, which responds to this point. Following comments from respondents, we modelled the effect of one year's delay to the potential benefits accruing to citizens and consumers – see paragraphs A2.94-A2.95 in the impact assessment and paragraphs A3.84-A3.87 of the modelling annex for further explanation of this sensitivity analysis.
Orange proposed that we should consider clearing channel 60 which could improve the quality of service for mobile broadband consumers, in line with original suggestions at the World Radiocommunication Conference 2007 (WRC-07) for 112 MHz to be cleared for mobile broadband use.	Task Group 4 (TG4) of the Electronic Communications Committee of the European Conference of Postal and Telecommunications Administrations (CEPT) concluded a harmonised sub-band for mobile communications (including uplinks) was feasible from a technical, regulatory and administrative point of view. It suggested as a minimum channels 62-69 (798-862 MHz) could be used. A mobile allocation at 790-862 MHz had been present in the Radio Regulations for a long time under footnote 5.318. As a consequence of WRC-07 and further work in CEPT, CEPT subsequently decided to align with this existing allocation as the basis for a harmonised sub-band. Creating a harmonised sub-band provides an opportunity for substantial economies of scale in mobile equipment, particularly handsets. Clearing channel 60 (782-790 MHz) in the UK would create an unharmonised channel that is likely to be difficult and costly to exploit efficiently. Full clearance of the channel would also add to the international coordination activities that need to be undertaken to clear channels 61-69 by the UK and other countries. In considering clearing channels 61, 62 and 69 we have stated 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. Increased UK and international usage of channels 21-60 will further increase the interference in an already interference limited DTT environment and will make it more difficult to meet this objective. Therefore as we state in paragraph A2.39 in the impact assessment, the case for clearing channel 60 of DTT transmissions was not assessed in our 800 MHz consultation.

Orange and T-Mobile also called for further clarity on the protection clause, proposed in our June 2008 consultation document on the detailed design of the cleared award.[3]	The protection clause is a method of mitigating interference into DTT services. We received a number of detailed responses on the practical implications for a wide set of issues that such a clause would raise. We intend to set out a more detailed and revised set of proposals for the protection clause in the late autumn. Prior to this we expect to hold a workshop on the protection clause with all relevant stakeholders.
Intellect, the Wimax Forum and BT all urged us to maintain a service and technology neutral approach to awarding the 800 MHz band.	We will consider issues of auction design and packaging when we set out how we expect to proceed with the digital dividend awards in the late autumn. We do however note the Digital Britain Final Report's[4] endorsement of the ISB's proposals for an auction of the 800 MHz band in 2 × 10 MHz pairs, which mirrors the CEPT band plan for frequency-division duplexing (FDD).
H3G said that we should consider implications of this award for 2G liberalisation given the similarities of spectrum in the 800 and 900 MHz bands. Respondents linked our proposals with the Digital Britain agenda to make this spectrum available as early as possible and the potential imposition of a universal service commitment, suggesting that it could lead to a change in the award process for the 800 MHz band.	In our 2G liberalisation consultation document we noted the potential relevance of 800MHz to future competition in the mobile sector. We are currently considering the responses to that consultation. Meanwhile, we note that the Digital Britain process is also considering these issues. We note that the Government is considering these issues in the context of the Digital Britain process and we await the outcome of that process prior to considering the award of this spectrum.
Broadcasters acknowledged the scale of the benefits to the UK as a whole would outweigh the costs, but highlighted that the process of clearing the 800 MHz band was a complicated process in which they would bear significant costs without realising any benefits. One broadcaster in particular questioned our approach of trading off benefits against costs, especially permitting negative impact on one group of stakeholders (in this case DTT) for the benefit of a different group.	Our principal duty is to further the interests of citizens and consumers. We do so by carefully weighing up the costs and benefits across all affected parties and then making a balanced judgement as to which course delivers the greatest benefits to citizens and consumers as a whole.

[3] www.ofcom.org.uk/consult/condocs/clearedaward/condoc.pdf.
[4] www.culture.gov.uk/what_we_do/broadcasting/6216.aspx.

Some broadcasters felt that we had downplayed the impact of consumer uncertainty due to the need to undertake retuning and possible knock on effects that this could have on the viability of the DTT platform itself through a possible loss of coverage and reducing its competitiveness against other digital platforms.	With regards to the impact of retuning, we commissioned a consumer study to help ascertain the exact scale (and cost) of retuning and also the type of support (i.e. help schemes) that will need to be put in place to help viewers. Coverage issues are closely linked with two related events: • the exact hybrid options that we decide to pursue to migrate DTT from channels 61 and 62; and • the final frequency plan, which will not be stable until international negotiations are ratified (at relay level) by mid 2010. We discuss these issues further in paragraphs 4.113-4.138 in section 4 of the statement.
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. Virgin Media claimed that this could raise significant costs to it and its customers and should be included in the cost/benefit analysis (CBA). Virgin Media also said that we should consider the financial implications of modifying its customer premises equipment and other network elements and that we needed to address this issue with urgency before any final decisions were made which would unreasonably impact such a large percentage of the UK viewing public and in some cases disadvantage their internet use.	Our understanding is that this is an issue of electromagnetic compatibility between cable systems and 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, as channels 63-68 were to be released for new uses irrespective of our policy on the full clearance of the band. Therefore it is not appropriate for this to be included in our 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. We understand that the situation here may be less severe than in other European countries as the main distribution elements of Virgin Media's UK cable networks are likely to be less susceptible to interference because the majority are underground. 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.

Some PMSE respondents reiterated their opposition to our market-led approach to awarding the digital dividend and called for the analysis to take account of a qualitative assessment of the value of PMSE.	Whilst we note these concerns, we have taken considerable steps to address the impact of a market led approach on the PMSE sector over the last two years. A key element of our work is to put in place a band manager which will have obligations to PMSE users. We have proposed that the band manager should provide access to its spectrum to the PMSE sector on fair, reasonable and non-discriminatory terms and conditions. This will provide protection for PMSE users as they make the transition towards a market-led approach to spectrum.
A handful of PMSE respondents rejected the proposal to clear the 800 MHz band because they did not agree that PMSE should be moved from channel 69.	We refer to our CBA, which strongly suggests that it is in the interest of citizens and consumers to clear the entire 800 MHz band in the UK. See paragraphs 3.12-3.28 in section 3 of the statement.
H3G 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. They also requested that no new deployment be permitted on these frequencies	We consider that considerable further planning is required before the clearance order is determined. In essence, we will try to integrate the clearance of channels 61 and 62 with DSO where possible. Due to the nature of the UK's broadcasting infrastructure, we are unable to decouple the clearance of these channels as it would require duplication of resources, thereby significantly increasing the costs of the programme and impacts for viewers. For further details on our view on new deployments in the 800 MHz band please refer to paragraphs 5.69-5.71.

Issue	**Our comments**
Questions 2-7. Moving DTT from channels 61 and 62	
Question 2. DTT migration criteria	
Some PMSE respondents disagreed with the migration criteria, arguing that similar protections should be provided for existing PMSE users of channels 61 and 62.	We dealt with this issue in paragraph 5.10 of the statement We set out the key objectives we believe are most appropriate for PMSE users in section 5.
Some broadcasting respondents, including the BBC, suggested that the criteria should be weighted and/or prioritised and trade-offs clarified.	We think it is too early to take these decisions and will consider these points further in discussions with stakeholders. See paragraph 4.20 of the statement.
The BBC proposed separating the migration criteria into decision, implementation and frequency planning criteria (and provided suggested criteria for each).	We will consider the BBC's suggestions further as part of our plans for implementation. See paragraphs 4.13 and 4.18-4.20.

Several broadcasters suggested that some of the criteria terms needed to be more clearly defined, for example, "reasonably incurred" and "consistency with existing policy objectives for DTT coverage after DSO".	We consider that, as constructed, the terms are appropriate. See paragraph 4.15.
Digital UK proposed undertaking a DSO impact study from which the implementation criteria for 800 MHz clearance could be developed.	We will provide input to Digital UK for that assessment as required. See paragraph 4.21.
BECTU suggested that any DTT replanning exercise should take into account technological developments such as DVB-T2 for rollout of services.	The DTT clearance proposals do not reconsider the transmission and coding technologies which provide DTT services. Rather they cover the way in which we might manage a change of frequencies which those services use for transmission. This issue lies outside the scope of this process and was therefore not further considered.
ACNI asked if there would be enough spectrum reserved for any other "unexpected requirement" in the future.	As set out in OUR December 2007 statement on awarding the digital dividend,[5] we have decided that it is not appropriate to hold back spectrum in reserve.
S4C, BBC and Five said that there should be no undue financial impact on broadcasters where there is no direct benefit.	We refer to our DTT migration criteria that 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. See paragraph 4.22.
Question 3. Migration options	
Broadcasting respondents asked for further assessment of the options before a final decision is made. The BBC suggested the Joint Frequency Planning Project (JPP) should decide between the two-step and hybrid options.	We agree that further technical analysis is required and will take time to fully assess. See paragraph 4.34.
PMSE respondents indicated a preference for allocating additional spectrum in channels 39 and 40 for PMSE use.	We address this issue in paragraph 5.43.
Whilst supporting the hybrid solution, Intellect was concerned that as many as 100,000 households may require new TV aerials.	Our assessment shows that the number of household aerials affected under the hybrid option is likely to be very low – at most 10,000 – compared with other options. See paragraph 4.37.
In view of the inevitable need to retune set top boxes and integrated digital TVs (iDTVs), RNID suggested that we should work to raise awareness amongst consumers especially people with disabilities and other vulnerable groups.	We agree that there may be certain steps we can take to facilitate and/or support industry in enhancing awareness of this issue. See paragraphs 4.40 and 4.129-4.130.

[5] www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf.

Orange asked for sight of a detailed project plan and regular updates on progress.	We will ensure affected stakeholders are kept informed. Stakeholders can subscribe on our website to receive free email updates.[6]
Orange and Arqiva noted the importance of completing international negotiations. The latter also highlighted the dependence on these of being able to bed down a frequency plan for the UK.	We note these points and are already working towards agreements with our international neighbours. See paragraph 4.35 and section 6.
David Hall Systems queried why the coverage impacts of changes in neighbouring countries' spectrum plans were treated differently.	More information was known about the hybrid option impacts as a result of responding to normal bilateral requests from these countries. See paragraph 4.39.
O2 did not think the consultation provided sufficient clarity on the number of households using group E aerials or how this was taken into account in the assessment.	Group E aerials alone do not adequately mitigate the viewer impacts. See paragraph 4.38.
Question 4. Implementation-timing options	
Digital UK, C4 and Five expressed concern over the additional resources (particularly Arqiva's) needed to study, plan and implement post-DSO implementation which may impact upon a DSO programme already stretched by the addition of the DVB-T2 project.	We are working closely with Arqiva and the BBC to ensure additional planning resources are deployed. See paragraph 4.60.
The BBC summarised the trade-offs involved in making a decision on timing.	We note and agree with the trade-offs identified by the BBC as being central to this decision. See paragraph 4.56.
While favouring DSO-integration where possible (although it was suggested by broadcasters that this would be limited), the BBC, Five, Digital UK and a multiplex operator indicated that post-DSO implementation would also be acceptable. The BBC suggested it should be considered as the base case. Broadcasters/multiplex operators questioned the true benefits of a DSO-integrated approach, which they felt offered limited scope for DSO-integration, because it could increase the risk of disruption to DSO.	We consider that, provided the DTT migration criteria are taken into account, the benefits of integrating sites or regions where possible cannot be ignored. See paragraphs 4.57-4.58.
Two broadcasters noted that post-DSO implementation was likely to be more costly than DSO-integration.	We agree and note that there are cost advantages to DSO-integration. See paragraph 4.57.
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.	In light of the DTT migration criteria, we agree. See paragraph 4.58.

[6] See www.ofcom.org.uk/static/subscribe/select_list.htm.

The mobile network operators (MNOs) suggested that timescales for clearance were conservative and lengthy in comparison with other European Union (EU) countries and there should be an early 2012 release of the spectrum. The broadcasters/multiplex operators indicated that the scope for DSO integration was limited and that 2014 was a more realistic timeframe.	We note the contrasting views presented by stakeholders and consider that completing the clearance of this spectrum by the end of 2013 remains challenging but credible. See paragraphs 4.59-4.60 and 4.64.
T-Mobile was concerned about the potential for delay and costs of an integrated approach until 2014 (or later), noting that our 2G liberalisation assessment specified that a three month delay could cost in the region of £45m.	We note the potential costs of delay and respond to this point in paragraph 4.61.
C4 and Digital UK noted that timing did not take account of DVB-T2 implementation plans which were already complicating DSO.	We are working closely with relevant stakeholders to ensure appropriate resources are deployed which do not impact on existing plans.
Orange supported the option which provided greatest certainty of delivering earliest clearance.	We agree and it remains a policy objective for the 800 MHz clearance to ensure the timely award of this spectrum.
H3G felt that the spectrum should be cleared region by region with an early staged rollout of broadband services in support of Digital Britain objectives, although Ericsson suggested that the spectrum be released at the same time and that a long staged release could affect the spectrum value and provide greater uncertainty.	We consider that it will require considerable further planning before the clearance order is determined.
Question 5. Programme control and governance arrangements	
T-Mobile expressed concern that overly complex arrangements could lead to delays.	We note that more work is required to develop and confirm these arrangements. See paragraph 4.74.
Digital UK, Arqiva and C4 thought that decisions on this aspect were premature with further work needing to be completed first, in particular on the funding arrangements and the role of the funding organisation(s).	We agree that it is difficult to finalise these arrangements in the absence of further clarity on funding and financial accountability. See paragraph 4.74.
Digital UK suggested that in order not to jeopardise DSO it should manage all the network changes until DSO is completed in 2012.	We believe that close cooperation with, and the support of, Digital UK will be essential. See paragraph 4.76.
David Hall Systems suggested that a conflict resolution process may need to be built in to deal with potential disagreements between parties.	We agree that there may be a need for a dispute resolution process. See paragraph 4.78.

Digital UK asked who would be Arqiva's client under the proposed arrangements.	Arqiva plays several important roles in the implementation programme, as set out in paragraph 4.77.
Digital UK advised that there may be a tension between the 800 MHz funding source seeking lowest cost speed of deployment and multiplex operators' requirements for network robustness.	The Government has confirmed it will fund the clearance, and we will oversee the disbursement of these funds. Our principle objectives will be to ensure the DTT migration criteria are fully taken into account throughout clearance, while allowing for the timely release of this spectrum. We will work to ensure network robustness is maintained throughout the clearance process.
A multiplex operator suggested that it should retain control over the requirements for network resilience.	We noted that we would need to review our Code of Practice on Changes to Existing Transmission and Reception Arrangements as part of this work.[7] See paragraph 4.82.
One respondent was concerned that it would be difficult to quantify costs in advance and to ensure potential funding/governance bodies properly understood the existing contractual arrangements for broadcasters/multiplex operators.	We understand the complexities of this work and will work with key stakeholders as we develop our plans for implementation, furthering our understanding of these issues, to ensure they are taken account of in decision-making.
The BBC suggested detailed planning of channel changes through JPP, with decisions taken by an Ofcom led steering group, but including key stakeholders	We agree and consider that there is a central role for JPP and will establish an internal steering group to oversee this work. See paragraphs 4.75-4.76.
Five and Orange made suggestions regarding representation within the governance and programme control arrangements.	We agree that affected parties should be represented throughout implementation. See section 7.
Question 6. Cost categories	
T-Mobile felt that the estimated retuning costs of £15m seemed overly high as retuning is a standard task which consumers should regularly be undertaking themselves.	This was a non-cash cost which we calculated on the basis of average time (estimated to be 15 minutes) spent per household on retuning equipment. We set out further analysis in the impact assessment – see paragraphs A2.65-A2.67.
Ericsson and Intellect suggested that in order to bid effectively for the 800 MHz band (if licensees funded the clearance) there would need to be much more evidence-based cost estimates and a narrower range of estimates.	The Government has now committed to meet the costs of clearing the 800 MHz band – see paragraph 3.30 – so we have not considered this point further.

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

Arqiva advised that to ensure there was no impact on DSO, it would need additional resources to carry out this work. These activities may also place an additional burden on Digital UK.	We are working closely with key stakeholders to appropriately resource this work. See section 7.
The BBC pointed out that the digital switchover help scheme (DSHS) will cease with DSO and will not then cover the clearance programme. S4C and the BBC suggested that it may be necessary to budget for a help scheme that will run post DSO.	We are unable to draw conclusions about the involvement of the DSHS at this stage. See paragraphs 4.102 and 4.131.
The BBC noted that there may be additional operational costs post clearance. Arqiva indicated that it will be hard to establish the likely costs until well into the planning phase – possibly after 2010.	We consider that the broad cost categories proposed sufficiently cover the types of cost that will arise and will work with stakeholders to further define the individual costs within these categories. We further conclude that the cost range is still appropriate. See paragraphs 4.105-4.106.
Several broadcasters/multiplex operators suggested an additional cost category of broadcaster compensation, which would cover management time, impact on services during retuning, loss of viewer confidence in DTT and loss of DTT coverage.	See paragraph 4.96 for our response. We cannot yet comment on proposals for compensation to be paid as we will not be able to draw conclusions until the technical plan is finalised. See paragraph 4.18.
Digital UK said that there was no explicit reference to the cost of planning and design activity required once spectrum planning is complete and before infrastructure re-engineering can commence. This work is in addition to the DSO and DVB-T2 programmes and is likely to require additional resources.	We agree that there is an ongoing planning and design requirement as implementation proceeds. We plan to work closely with Digital UK, its Broadcast Infrastructure Group and the Technical Infrastructure Planning Group which we intend to establish, to address these matters. See section 7 for further information.
The BBC suggested that there may be new (ongoing) costs arising from clearing channels 61 and 62. (For example, some rebroadcast links (RBLs) might become unviable and require lines to be installed and other additional sites might be required to meet the target coverage criterion.)	We are unable to fully assess these requirements until the frequency plans are confirmed. However the planning work we will instigate alongside implementation will have a key role in assessing these and the groups involved would be expected to provide advice to us on any network infrastructure changes that will be required as a result. We consider that existing broadcast infrastructure costs adequately cover the scope of any such proposed work.
The BBC suggested that costs to viewers ought to be taken into account, for example, the cost of purchasing and installing new receiving equipment, reorienting aerials or for installers to retune televisions or set top boxes.	These costs have been included in our impact assessment. We agree that based on DSO experience to date, some viewers (particularly vulnerable groups) will find retuning difficult and will need a further level of support. We therefore identified a cost category for consumer support in the consultation which includes support costs for vulnerable viewers.

An individual respondent advised that there was an issue for communal aerials such as those used in flats. These may require retuning or replacement by experts and DSO timing means that this may happen twice in some circumstances.	We agree that these changes will also mean that some communal aerial systems – in multiple dwelling units such as those used in student halls, flats and care homes – may require retuning. We discuss this issue further in paragraph 4.97 and in the impact assessment.
Five felt that the costs of communicating with viewers should be met by the clearance programme and not by broadcasters.	These costs have already been included within the scope of the communications and support cost category.
Question 7. Cost profile	
The BBC, Intellect, C4 and Five felt that there was no certainty in the cost profile until planning had been completed.	We agree that the absolute cost and the spend profile of the clearance programme cannot be confirmed until planning work is completed. However we do think the cost range presented is still appropriate. See paragraph 4.106.
A respondent suggested that funding arrangements must be in place before work starts.	The Government has committed to meet the costs of clearing the 800 MHz band. See paragraph 3.30.
Digital UK and several broadcasters/multiplex operators were of the view that timescales for infrastructure, communications and therefore programme management will be shifted into 2014.	We consider that completing the clearance of this spectrum by the end of 2013 remains challenging but credible. See paragraph 4.64.
C4 believed that it was unlikely that clarity of costs, their profile and the overall work plan will be completed within the timescales suggested.	We will provide further clarity on these matters in our plans for implementation which will continue during 2009. See section 7.
Other issues: DTT coverage	
Several broadcasting respondents thought that we should carry out analysis regarding the number of households that will fall out of DTT coverage after these changes (particularly if those households gained it through DSO).	We agree that further detailed analysis is required. See paragraph 4.114.
C4 thought that it would be unlikely that any coverage impacts could be delineated simply as affecting public-service broadcasting (PSB) – or PSB and commercial – multiplexes. Five anticipated the commercial multiplexes would be differentially affected, with tens of thousands of households potentially impacted.	We establish 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. See paragraph 4.113.
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 that there may be a need for additional relay sites to restore lost coverage, especially in southeast England.	We will consider options to boost coverage should any significant losses arise. See paragraph 4.114.

Other issues: retuning	
Some broadcasters and multiplex operators predicted that retuning impacts were likely to be more severe than forecast (on the basis of recent Selkirk and Rowridge examples). Five and Digital UK noted, however, that lessons from DSO together with increasing viewer awareness will assist in better informing and preparing viewers for retune events.	We agree that viewers will become more comfortable with retuning through DSO but that managing this process will still require careful planning, particularly for vulnerable groups. See paragraphs 4.119-4.122.
T-Mobile thought, in light of the experience that households will gain from DSO, that we were overestimating the impacts of retuning.	Although many viewers may find retuning their equipment simple to manage, especially after gaining experience through DSO, there are some viewers for whom this will remain a difficult and confusing task, and therefore we disagree that we are overestimating the impacts. Our assessment takes account of the time each household will on average take to retune equipment and the communications and support likely to be required to inform viewers around retuning dates and activities required in each area.
The BBC 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 high definition services on DTT) will bring, although it suggested that these implementation costs should be covered by this programme.	We agree that the introduction of auto-retuning mechanisms in new equipment, particularly in equipment provided through the DSHS, will help to mitigate these impacts significantly. See paragraph 4.122.
Other issues: consumer messaging and support	
Digital UK made a number of suggestions for how we might manage consumer communications and support.	We note Digital UK's suggestions, and will consider them as part of our implementation planning. See paragraph 4.129.
Stakeholders 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.	Any extension of the DSHS is a decision to be taken by the Government in conjunction with the BBC, which manages the process. See paragraph 4.131.
Digital UK also noted that the proximity (and potential overlap) of DTT clearance to DSO may have implications for the messaging and/or credibility of DSO.	We note Digital UK's concerns and agree that decisions on managing this impact should be taken in consultation with Digital UK. See paragraph 4.132.
Five wanted to ensure consumer communications clarified that 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.	We note Five's and other's concerns and address them in paragraph 4.133.

The BBC and Arqiva called for a free aerial replacement programme for affected viewers.	Our plans do take account of an assistance programme to support vulnerable viewers, and this is included in our cost profile. It is not yet clear what level of support will be required and the extent to which aerials will need replacing as we will not be able to draw conclusions until the technical plan is finalised.
Other issues: DTT platform effects	
The BBC (and several others) raised concerns that the continued retunes would adversely impact the DTT platform brand.	We see no evidence to support this view. See paragraphs 4.138-4.139.
Some broadcasters and multiplex operators also noted that the revised 600 MHz award could constrain the opportunity for DTT growth (i.e. for a seventh DTT multiplex).	We do not agree. See paragraphs 4.140 and A2.84 in the impact assessment.

Issue	Our comments
Questions 8-15. Moving PMSE from channel 69	
Question 8. Criteria for assessing replacement for channel 69	
Intellect, Motorola and BT recommended that the overall PMSE demand for spectrum and availability of interleaved spectrum should be assessed, so that the need for a dedicated channel could be reviewed and PMSE could potentially be moved out of UHF Bands IV and V. This assessment should be carried out in light of technological improvements that enable more efficient spectrum use by PMSE. Allocation of spectrum to PMSE should be proportionate and not preclude other valuable applications and technologies from using the spectrum.	Moving PMSE users out of UHF Bands IV and V is likely to cause significant disruption, contrary to our objective for the PMSE sector, and adversely affect their ability to provide services to their customers. Economic, technical and coverage issues mean that PMSE requirements are most likely to be satisfied by spectrum that is broadly equivalent to the spectrum that they use today. See paragraphs 5.2-5.46 for further details of our analysis of the suitable alternative spectrum for PMSE use.
PMSE respondents, led by BEIRG and PLASA, asked for clarity over the overall amount and configuration of interleaved spectrum ('white space maps").	We have noted concerns about the total amount and configuration of interleaved spectrum that will be available for PMSE after DSO. As such we plan to publish further information on the availability of interleaved spectrum soon, which will take into account the revised DTT protection approach.
A few PMSE respondents called for the permanent allocation of channel 37 to PMSE to compensate for the reduction in total spectrum available to the sector following DSO and to allow for future PMSE expansion.	We do not envisage a reduction in spectrum available for PMSE use following DSO. In fact, we believe that there is sufficient spectrum to meet historic peak PMSE demand in both the interleaved spectrum to be awarded to the band manager and in channel 38, which we note will be adjacent to DTT in channels 39 and 40.

<table>
<tr><td>BEIRG called for two additional channels to be reserved for PMSE until there is certainty that the available spectrum will satisfy demand, in particular noting the importance of access to contiguous spectrum for touring productions.

In support of allocating further spectrum in channels 37-40 to PMSE, BEIRG said:

• the same equipment could be used across Europe and equipment costs could significantly fall;

• it would compensate for the loss of spectrum as a result of the more intensive use of channels 21-60 for DTT;

• their proximity to interleaved spectrum in channel 41 and above may reduce impact of fragmentation; and

• high-end equipment for these channels is already produced (although lower-end products would need to be developed for community users).

BEIRG also argued for reorganisation of the DTT multiplexes to free up more cleared channels for PMSE in the 600 MHz band.</td><td>The task at hand is to find broadly suitable replacement spectrum for channel 69, i.e. a single 8 MHz channel in UHF Bands IV and V available on a UK-wide basis. However, we note BEIRG's concerns and will keep this matter under review. See paragraphs 5.12-5.14.</td></tr>
<tr><td>Orange commented that PMSE is not a service protected by the International Telecommunication Union (ITU) and suggested that this has implications for the coverage criteria, especially as they do not provide national coverage.</td><td>The ITU status of PMSE does not have any identifiable relevance to our proposals for the sector and the decision to clear channel 69 of existing use.</td></tr>
<tr><td>Some respondents suggested the potential benefits of European harmonisation that may be provided by the FDD duplex split should be taken into account.</td><td rowspan="2">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, as set out in paragraph 5.23.</td></tr>
<tr><td>H3G said that the FDD duplex gap was not appropriate for PMSE due to the very tight interference requirements.</td></tr>
<tr><td>One private individual commented that the potential benefits of aligning the replacement channel with PMSE frequencies available in the US should be considered.

JFMG said that the availability of equipment in the UK and Europe should be considered.</td><td>We agree that there are potential benefits for PMSE users of realising economies of scale by exploiting common tuning ranges across different countries. We would therefore support any industry led initiatives to adapt equipment to take advantage of this.</td></tr>
</table>

RNID and the BBC said that technical implications for audio induction loops should be considered and taken into account when assessing any replacement. RNID expressed concerns that the proposals could potentially cause significant difficulty to existing deployments as well as with regard to the availability and cost of new equipment. RNID was concerned that the wider implications for such installations, and the resulting barriers for people with hearing loss who rely on induction loop systems, have not been considered with due care or that suitable and equivalent solutions have been proposed.	We have discussed this issue with RNID. We understand that whilst wireless microphones are a key input into induction loop systems, the successful operation of those systems is not dependent on any specific frequency that the microphone operates at. We also understand that it is likely that a significant amount of equipment currently used for this purpose may be able to retune to and use channel 70 (863-865 MHz) on a licence-exempt basis. Where existing equipment cannot retune to available frequencies, the replacement spectrum that we have identified and parallel funding arrangements should ensure that the service for these stakeholders continues.
The Royal National Theatre and one private individual said that current unlicensed users of channel 69 should be factored in when estimating likely demand for the replacement spectrum as the move provides the opportunity to ensure these users become licensed.	Because of its nature, we cannot accurately determine the level of unlicensed channel 69 use. However, the current situation suggests that licensed PMSE users can use channel 69 without significant risk of interference from whatever unlicensed use there is. We have no evidence that suggests that this will not also be the case with PMSE use of channel 38
One respondent (who wished to remain anonymous) questioned the approach of charging PMSE users Administered Incentive Pricing (AIP), suggesting there was an intellectual difficulty with reserving spectrum for the sector for public policy reasons then charging users the price they may have expected to pay at auction. Another respondent also queried the application of prices based on opportunity costs to the PMSE sector.	This issue is addressed in our second, June 2009 consultation on the detailed design of the band manager award.[8] We also describe the protections that we propose to introduce to ensure that this move does not cause significant disruption to those PMSE users who may see an increase in their fees.
JFMG stated that the replacement spectrum should allow for the continuation of the light-licensing regime whereby 14 set channels are available UK-wide on an uncoordinated basis.	We consider that comparable shared licensing arrangements to those used for channel 69 should continue with channel 38. To that end, we have asked JFMG to ensure that there is a set of frequencies for a channel 38 licence that will serve this purpose. See paragraphs 5.81-5.83. These licences will be available after we have consulted on the precise frequencies which will make up the shared licence and published the new arrangements. This will be part of the consultation on the implementation of channel 69 funding, which will be published shortly.

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

Two private individuals raised timing as an additional factor to consider when assessing the replacements for channel 69. One said that the final decision must take account of the time required for new equipment to be developed and tested and another said that the suitability of each option throughout implementation should be considered, i.e. the possible impact of increased use of channel 70 during migration.	Channel 38 is already available for PMSE use and equipment already exists to use this spectrum. As a result, we expect that manufacturers will not need significant development time. We announced in the statement that the migration period for PMSE users from channel 69 would last until at least 1 January 2012 (when channel 38 will be available UK-wide). We also stated that there may be scope for this period to be extended, depending on the outcome of the work the Government has initiated to resolve the key questions raised by the ISB's report for Digital Britain. We accept that channel 70 may play a role in the migration from channel 69 and are continuing to explore potential for expanded use of this channel for wireless microphones.
Question 9. Technical and coverage analysis	
<u>Channel 38</u> Many respondents stressed that channel 38 would only be a suitable replacement subject to assurances on UK-wide availability, freedom from interference and adjacency to interleaved spectrum. The BBC said that there was not yet sufficient certainty about the level of usage of channels 39 and 40 and the future use of channel 37 was dependent on the outcome of the cleared award.	We consider that channel 38 is the most suitable replacement for PMSE use of channel 69. See paragraphs 5.42-5.46. We do not believe that adjacent interleaved spectrum is a necessary consideration in finding suitable replacement spectrum for PMSE use but note that channels 39 and 40 will be used for DTT broadcasts and the interleaved spectrum therein will be awarded to the band manager. The exact quantity of this interleaved spectrum is unlikely to be clear until international frequency planning is finalised. Similarly, new uses in channel 37 will not be identified until the 600 MHz award is concluded.
<u>FDD duplex gap</u> Arqiva, Nortel Networks, Qualcomm, T-Mobile and O2 recommended further consideration of the FDD duplex gap as the replacement for channel 69 due to the potential benefits of European harmonisation. BEIRG, JFMG and Arqiva said that there was not sufficient certainty that PMSE could practically use the FDD duplex gap in order to allocate it as the channel 69 replacement. Many respondents suggested the FDD duplex gap might be useful additional spectrum for use by PMSE after the cleared award.	The FDD duplex gap is a potential outcome of the award of the 800 MHz band. However there is not sufficient certainty about the availability of this spectrum to consider it a viable replacement for channel 69 for PMSE sector. See paragraph 5.23. We agree that the duplex gap might be useful additional spectrum for PMSE use and we see no reason why the band manager (which should be operational by then) could not participate during an award process.

<u>Interleaved only</u> Many respondents dismissed the interleaved-only option as a viable alternative to channel 69. BEIRG and JFMG said that this option should not be subject to further discussion as its use as a replacement would result in a reduction in the overall channels available for PMSE as it was already due to be awarded to the band manager. Arqiva said that it was not a suitable replacement as there was no guarantee of a contiguous block of 24 MHz of spectrum. Similarly, BEIRG suggested our analysis overstated the suitability of interleaved spectrum as a replacement due to fragmentation and the difficulties in providing a full UK-wide channel in this spectrum. The BBC said that the shared use in channel 69 could not be replicated in interleaved spectrum due to the potential for interference from DTT. It also said that the interleaved only option would not be an alternative for those with hearing difficulties. PMSE users would require equipment with a wider tuning range to operate in the interleaved spectrum post-DSO. This would be more expensive, more susceptible to interference and subject to higher licensing costs due to the need for location-specific frequency coordination. JFMG said that the need to regularly retune equipment and purchase multiple sets to achieve the same utility as channel 69 would be impractical. Some respondents questioned the technical feasibility of producing equipment with a tuning range over 24 MHz and asked us to produce evidence that this would be possible.	These issues are addressed in paragraph 5.22.
One respondent suggested that the need for miniaturisation and antenna design may limit development of equipment that tunes over a wider range. The same respondent also suggested that the difficulties experienced by UK manufacturers as a result of these proposals have prevented them from investing in the necessary technological research and development.	We recognise that there are technical challenges facing manufacturers in developing wide tuning equipment. However, we are also aware that equipment does exist on the market that tunes over more than the “standard” 24 MHz range. We believe our statement removes any uncertainty over the replacement spectrum for channel 69.

A number of PMSE respondents called for consideration of the impact of shared use of interleaved spectrum with cognitive devices and possible interference. One private individual suggested that licence-exempt use of interleaved spectrum by cognitive devices may decrease its value.	We set out in our December 2007 statement that we would allow licence-exempt cognitive access to interleaved spectrum as long as we were satisfied that it would not cause harmful interference to licensed uses, including DTT and PMSE. We published a statement on the technical parameters for cognitive access on 1 July 2009.[9]
1785-1800 MHz In response to our analysis of this option, BEIRG and several individuals said that the use of digital wireless microphones by theatres is still uncommon and the efficiency is unproven. The Royal National Theatre said that the health and safety risk posed by operating body-worn equipment in these frequencies at the required power levels must be considered.	We recognise the current uncertainty over the use of digital microphones and reflected this in our decision not to propose these frequencies as the replacement for channel 69. We did not consider health and safety issues having already ruled out this spectrum as the replacement for channel 69.
Question 10. Economic assessment	
Some respondents questioned our assessment of the relative opportunity costs of channel 38 and the interleaved-only option. BT queried whether more interleaved spectrum would be reserved for PMSE if the interleaved-only option was pursued or whether there was already sufficient capacity but technological limitations were constraining its use. BT suggested that if no additional interleaved spectrum would be required then channel 38 would not represent an economic advantage. Conversely, BT said that if the use of channel 38 led to a reduction in the amount of interleaved spectrum required then there could be further advantages in allocating it for PMSE. Intellect stated that much of the interleaved spectrum is available to PMSE, therefore there would be no additional opportunity cost if this spectrum was awarded as the replacement. It suggested that PMSE use of interleaved spectrum could be consolidated into fewer channels if channel 38 was awarded to the band manager as less interleaved spectrum would be needed to meet PMSE demand.	We did not plan to allocate more interleaved spectrum to PMSE than we are at present even if we had pursued the interleaved-only option. This is because we consider that there is sufficient interleaved spectrum to meet peak PMSE demand, based on existing use. Nevertheless, this does not diminish the importance of channel 38 for a large number of PMSE users because it will be the only spectrum which allows them to operate on a UK-wide basis free from interference. We agree that adopting interleaved spectrum as the replacement for channel 69 would not have an impact on the opportunity cost of the spectrum. The band manager with obligations to PMSE will have incentives to promote more efficient PMSE use of interleaved spectrum if this is possible.

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

Several respondents asked us to clarify how long PMSE users could reasonably expect to have access to channel 38 free from interference and without a significant increase in cost, bearing in mind constraints on its use because of radioastronomy in the Netherlands.	The timing for access to channel 38 is set out in paragraphs 5.75-5.80. We address high-powered use of channel 38 in paragraphs 5.85-5.89. The wider issue of long term PMSE tenure of spectrum is subject to consultation as part of the band manager award. We expect to publish a statement on this award in the autumn.
Question 11. Channel 38 is the best alternative to channel 69 for PMSE	
One private individual suggested there needed to be further consultation on the technical feasibility of channel 38 before a decision could be made.	See paragraphs 5.24-5.25.
Question 12. Award channel 38 to the band manager on the same terms as would have applied to channel 69	
BEIRG stated that we should ensure that the benefits of the channel 69 licensing scheme (including UK-wide access) are replicated in the replacement channel as soon as possible.	We have decided to award channel 38 on similar terms and conditions as channel 69 and this will include comparable licensing arrangements – see paragraphs 5.53-5.57. In particular, channel 38 will be available with shared frequency licensing arrangements.
A number of respondents argued that channel 38 should be awarded to the band manager on indefinite terms subject to revocation on notice from us. Others said that the protection period for PMSE should at least be extended beyond 2018. One private individual said that the notice period should be at least five years.	These issues are subject to consultation as part of the band manager award. We expect to publish a statement on this award in the autumn.
JFMG stated that to maintain the same access regime as channel 69, a future band manager would also have to stipulate similar licence terms and conditions. JFMG pointed out that such provisions were not addressed in the July 2008 band manager consultation.	In our June 2009 band manager consultation, we have set out how we would expect the band manager to authorise PMSE use of its spectrum. In that consultation we set out proposals under which the band manager would provide access in a way that met the specific needs of PMSE users.
Question 13. Maintain PMSE access to cleared spectrum until 2012 and to channel 36 on 12 months' notice to cease	
Qualcomm and Vodafone said that as the 800 MHz band will not be used for mobile services until it is fully cleared, PMSE use can be allowed until DSO is completed – but we must ensure the band is cleared as soon as possible after that date.	See paragraphs 5.69-5.71.

O2 agreed to PMSE use of cleared spectrum until the London 2012 Olympic Games and Paralympic Games but said that access should cease immediately after the Games rather than after DSO. PMSE users should be able to approach the licensee to negotiate on a commercial basis since cleared spectrum would be tradable.	See paragraphs 5.69-5.71.
BT said that continued PMSE access to the spectrum should be a matter for the new licensee and subject to commercial agreement.	See paragraphs 5.69-5.71.
H3G did not support temporary PMSE access to channels 63-68, arguing that it would prevent mobile broadband deployment. H3G did accept channel 65 could be used for low power uses on a temporary basis until DSO is complete.	See paragraphs 5.69-5.71.
Intellect also disagreed with the proposal, arguing that if the awarded spectrum is cleared of TV use the option to deploy new services should be available immediately (recognising that it could be sublet on commercial terms if not required).	See paragraphs 5.69-5.71.
Orange asked for a review of channel 60 before a final decision is taken on whether to maintain these channels for PMSE.	Any PMSE access to channel 60 is dependent on PMSE not interfering with primary users in the same spectrum or users of adjacent spectrum. This will continue to be the case in the future.
Ericsson argued that all the digital dividend should be released at the same time as it would impact on valuations at time of award.	We note Ericsson's comment but consider that it is inevitable that there will be value differences in the spectrum and timing of clearance is one of the factors. Others such as adjacency to DTT (e.g. channel 60) remain.
The BBC stressed the importance of availability of compatible PMSE equipment during the London Games. It said that we may need to allow use of this band by those with hearing difficulties.	We intend to allow PMSE use of the 800 MHz band in London for the 2012 Games. See paragraph 5.70.

One respondent (who wished to remain anonymous) agreed with allowing PMSE temporary access to this spectrum but said that the deadline should correspond to actual completion of DSO rather than a specific date, especially if DSO is delayed. One confidential respondent said that we should plan for the possibility of PMSE continuing to use some of this spectrum in 2013 as the full 800 MHz band may not be cleared until 2014 in any case.	See paragraph 5.71.
BEIRG argued that temporary PMSE access to cleared spectrum should continue beyond the end of DSO until it is awarded and used for new services.	See paragraphs 5.69-5.71.
BEIRG also said that no AIP should be charged for this temporary access to spectrum. This would be more efficient, increase revenue for the band manager and further our objective of moving PMSE to market-based spectrum access.	Our June 2009 band manager consultation sets out our belief that the opportunity cost – and hence AIP – for temporary PMSE access to cleared spectrum should be zero.
A couple of respondents stated that access to this spectrum for PMSE during the London Games would be particularly helpful.	We agree. See paragraph 5.70.
Some respondents suggested that PMSE might require access to cleared spectrum until at least 2012 as they noted that migration depended on the availability of channel 38 and implementation of funding mechanisms. PLASA suggested that as the transition from channel 69 to channel 38 is likely to take three years from the point when full PMSE access to channel 38 is secured, PMSE might require access to channel 69 beyond 2012.	See paragraphs 5.69-5.71.
JFMG supported our proposal to continue PMSE access to cleared spectrum until late 2012 but noted that this provision does not extend to channel 36 and suggested that it would be easier for PMSE users to have a single deadline to vacate the cleared spectrum.	See paragraphs 5.69-5.71.
JFMG favoured provisions in the award of channel 36 allowing continued PMSE access (facilitated by the band manager) until the owner is ready to roll out its infrastructure. This would improve efficiency and afford current channel 36 users a longer timescale to vacate.	See paragraph 5.71.

Question 14. Eligibility and funding	
T-Mobile would be concerned if unlicensed users qualified for financial assistance. Some others respondents argued that unlicensed users with channel 69 equipment should be considered for funding.	We will not provide funding to those PMSE users who have never held a licence. See paragraph 5.117.
H3G and O2 expressed concern that channel 69 equipment may remain in circulation and cause interference problems. O2 asked if we would take proactive measures to remove channel 69 equipment from circulation.	The widespread deployment and use of mobile terminals will, in general, render the use of wireless microphones in channel 69 difficult as performance will become unreliable. As a result, we expect that these users will themselves be incentivised to change equipment in advance of 2012. Any illegal use thereafter should not cause undue impact into any mobile service using this channel.
The majority of PMSE respondents and three broadcasters argued that excluding from funding those who purchased channel 69 equipment or licences after the publication of the consultation on 2 February 2009 had had a detrimental impact on UK manufacturers as investment in equipment had stopped due to lack of certainty over channel 69 or its replacement. They called for swift confirmation of channel 38 as the replacement channel and its early availability on a UK-wide basis. They further argued for full funding for channel 69 equipment purchased up to this point (rather than imposing the 2 February cut-off date).	See paragraphs 5.112-5.116.
As such, BEIRG urged us to: • accept that some users had no choice but to invest in existing channel 69 equipment and work with the Government to underwrite any such reasonable investments; • confirm channel 38 as the replacement for channel 69 as soon as possible; and • ensure channel 38 is widely available for PMSE use as soon as possible. (It suggested that geographical and temporal constraints needed to be addressed, the bandwidth required by radioastronomy should be reviewed to determine whether more capacity could be made available to PMSE and the possibility of partial or full clearance by radioastronomy before 2012 should be pursued.)	We confirm channel 38 will be made available for PMSE use and set out the terms of access at paragraphs 5.72-5.80. We will shortly consult on whether users who purchased channel 69 equipment after 2 February 2009 should be eligible for funding, as explained at paragraphs 5.112-5.116.

Arqiva proposed a scrap scheme which replaced 800 MHz equipment with new equipment operating in the replacement spectrum, saying that this would achieve the fastest and cleanest result. Arqiva said that funding should be generous.	We will publish details of the mechanism for disbursing funds after our subsequent consultation.
One respondent (who wished to remain anonymous) questioned our approach to estimating the level of funding and suggested that the dynamic impact on costs should be considered. For instance, it is not appropriate to assume constant replacement cost for wireless microphones as it is possible that prices will increase because each party in the value chain will seek to earn a margin. The same respondent supported our upper estimate of the cost per microphone.	We will publish details of how we will calculate the level of funding after our subsequent consultation.
BEIRG and other PMSE respondents said that all PMSE users impacted by DSO should receive funding. BEIRG argued that despite the fact that PMSE users were informed in 2006 about the clearance of channels 31-40 and 63-68, they and manufacturers have been unable to make investment decisions in the absence of certainty over the frequencies available to PMSE and therefore should have access to funding.	See paragraph 5.115.
BEIRG said that PMSE users of channel 61 and 62 should receive funding on the same basis as those moved from channel 69.	See paragraph 5.114.
PMSE and broadcasting respondents suggested that we had underestimated the financial burden of replacing or modifying equipment and proposed the full cost of the replacement equipment should be met, especially as there would be no second-hand market and equipment holds value for a period of longer than the proposed 10 years.	We will address detailed funding points and set out our methodology for calculating exact amounts in our subsequent consultation.

BEIRG and other PMSE respondents said that the following factors should be taken into account when assessing funding eligibility: • anomalies in the current licensing scheme; • users who did not hold a channel 69 licence at the time of purchase (before 2 February 2009) but did plan to hold one before using the equipment (after 2 February 2009); • equipment that tunes to channel 69 but is used in other channels such that the user may not hold a channel 69 licence; • a single channel 69 licence could cover any number of systems; • rental companies that own channel 69 equipment but hold no licence; • lifespan of equipment is often longer than 10 years and it maintains value until it no longer works, regardless of age (the maximum depreciation is far less than the lifespan of a product). Expensive, highly engineered equipment is built to last 15 years. Well looked after equipment continues working for longer; and • only certain type-approved PMSE equipment is legal in the European market.	See paragraphs 5.110-5.120.
BEIRG suggested that we should compile a list of equipment that meets the legal specifications for the purposes of assessing entitlement to funding on a case-by-case basis.	We will address detailed funding points and set out our methodology for calculating exact amounts in our subsequent consultation.
BEIRG favoured Government funding and stressed the importance of an effective distribution mechanism. H3G also said that the cost should be met by the Government.	The Government confirmed that funding will be provided for clearing the 800 MHz band in the Digital Britain Final Report.
Question 15. Three year transition period	
Orange supported clearance by the end of 2012 and urged us to give regular updates as we cannot afford for timescales to slip.	Updates will be provided to PMSE licensees through JMFG. Non-PMSE licensees should register on our website for updates.
H3G said that three years is too long. PMSE users should be moved out efficiently and in a timely manner.	See paragraphs 5.69-5.71.
The BBC said the three year period was the shortest reasonable time period for PMSE to move from channel 69.	See paragraphs 5.69-5.71.

The BBC said that users of equipment with hearing difficulties would need a similar transitional period.	All users of wireless microphones (including those supporting induction loop systems) will be subject to the same migration period.
PMSE respondents, Vodafone and one confidential respondent stressed that efficient migration was dependent on manufacturers' ability to produce equipment and therefore they needed certainty on the replacement spectrum as soon as possible.	We set out the replacement spectrum for channel 69 in the statement and continue to believe that three years is a reasonable – if challenging – migration period for all PMSE users. At this stage we can confirm a migration period only until 1 January 2012, although it may yet be possible for PMSE access to the 800 MHz band to continue up to the completion of DSO in late 2012 depending of the outcome of work the Government will expedite to resolve the key questions raised by the ISB's report for Digital Britain.
Vodafone and one confidential respondent also said that it was important to make use of channel 38 as straightforward as possible in the period before it is fully vacated and that protection for radioastronomy could possibly be relaxed.	We will facilitate early use of channel 38 by PMSE. See paragraphs 5.72-5.80.
One private individual suggested that if the transition is less than five years, the short term high demand for new equipment will encourage manufacturers to charge premium prices rather than achieve lower priced, high turnover products, which would be more desirable.	There is no evidence to suggest that the PMSE equipment market – which is international in nature – is not competitive such that manufacturers/retailers will be able to charge excessive prices to end users.

PMSE respondents varied in confidence over their ability to complete the migration in this timeframe. Some felt it was possible given the following caveats, but others saw these factors as barriers to completing the transition in three years: • UK-wide availability of channel 38; • funding arrangements and transition plan in place; • simultaneous access to channel 69 and channel 38 throughout the period; • sufficient manufacturing capacity to support demand for (a) replacement channel 38 equipment and (b) modification of equipment especially in light of increased pressures during the London Games; and • more certainty over the configuration of interleaved spectrum so that fixed site users could be encouraged to move to interleaved spectrum rather than channel 38 (as they do not require the advantage of UK-wide access). This could help mitigate the strain on manufacturers by spreading the burden of a larger range of equipment and reduce the total amount of channel 38 equipment required.	We note these concerns. See paragraphs 5.69-5.71. We give further details of how channel 38 will be made available for PMSE use at paragraphs 5.72-5.89.
JFMG favoured moving PMSE from channel 69 as soon as it is practicable to avoid the administrative burden of a last minute move but suggested that equipment availability and the absence of UK-wide access to channel 38 until 2012 would constrain this process. JFMG suggested there would be scope to negotiate earlier release of the spectrum by radioastronomy or consider relaxation of the current restriction areas. Alternatively JFMG suggested that spot frequencies in adjacent channels could be identified allowing users to switch to frequencies outside channel 38 (pre-programmed by manufacturers) in areas where channel 38 access was restricted in order to replicate the current shared licensing arrangements in channel 69. JFMG intended to investigate this option further.	We are exploring early use of channel 38. See paragraphs 5.78-5.80.
JFMG suggested that licensing arrangements should be put in place that will aid the transition, using a similar system to when VHF frequencies were amended.	We note JFMG's comments and will work with it to put in place appropriate licensing arrangements to aid transition.

JFMG urged consideration of the frequency assignments in channel 38 in order to minimise the impact on existing channel 38 PMSE licensees and ensure that progress with developing licensing documentation and equipment manufacture can be made at an early stage. JFMG acknowledged that compromise will be necessary in determining the frequency plan.	We note JFMG's comments and will work with it to put in place appropriate licensing arrangements to aid transition. We will also consult on proposed frequencies that should be used for shared licences in our subsequent forthcoming consultation.
JFMG raised the issue of unlicensed channel 69 users who are likely to continue using the channel and therefore suffer interference post-2012. While acknowledging that these users may just switch to unlicensed use of channel 38, JFMG suggested that it may be possible to encourage them to buy a licence through a publicity campaign promoting the benefits, i.e. these users may have been eligible for funding if they had held a licence. Other PMSE respondents also urged us to launch a publicity campaign to encourage licensed use.	We agree that further efforts should be directed at reaching unlicensed users. We have recently contacted representative groups for "community" users (i.e. amateur theatres, faith groups, local authorities, schools and universities), asking them to pass messages on spectrum changes and the necessity of having a licence to their members. We have been in subsequent contact with some of these organisations to assist them in passing on those messages. In the coming year we will explore other measures that can be taken to educate users of the need to hold a licence. In the longer term, the band manager will have a financial incentive to deal with this matter effectively.

Issue	Our comments
Question 16. Impact assessment	
MNOs were mixed in their views on the size of the benefits to Long Term Evolution (LTE). O2 claimed they were overstated, due to overestimated relative and absolute site numbers, and the assumption of three new networks. H3G supported this by saying 2 × 15 MHz was the minimum efficient bandwidth for LTE. Vodafone stated they were conservative. T-Mobile suggested the protection clause should not materially affect the value of any channel.	We do not agree with the points raised by O2, for the reasons set out in paragraph A1.19 in the impact assessment. We agree with Vodafone that the benefits modelled and presented are indeed a conservative assessment. Value differences in the spectrum due to adjacency issues are inevitable. We will to the extent possible provide full details of the interference environment and mitigation measures new licensees can take as we take forward the award of the 800 MHz band.

Some respondents suggested that the benefits of earlier release of spectrum had not been adequately addressed. BT argued that these could include non-LTE use of the 800 MHz band and (per our 2.6 GHz approach) competition benefits. H3G argued the early release of channel 69 had not been properly addressed. H3G argued that DSO-staged release should be evaluated (e.g. to support regional wireless broadband).	We have addressed the benefits of early release by undertaking a sensitively analysis on the impact of delaying the release of this spectrum by one year. See paragraph A3.84 in the modelling annex. In relation to H3G's point on channel 69, see paragraphs 5.69-5.71. With regards to DSO staged release, our plans to clear channels 61 and 62 are based on the earliest possible time given our objectives not to disrupt the DSO timetable and to maintain PSB and commercial multiplex coverage obligations. We are considering, on a practical level, where we can reasonably integrate clearance of these channels along with DSO
Other respondents queried the accuracy of the harmonisation benefits, with Intellect and Nokia both suggesting that standard receivers (and reduced service) would be the outcome of non-harmonisation (vs. non-standard receivers as we assumed in the impact assessment)	See paragraphs A2.58-A2.59 in the impact assessment for our explanation of the methodology we have employed to assess harmonisation benefits.
Digital UK stated the expected start of benefits should be later (end-2014, not end-2013), citing both international negotiations and DSO as relevant critical path elements.	See paragraphs A2.55-A2.56 in the impact assessment.
Broadcasters and multiplex operators believed we had understated the negative impact on viewers of the existing six DTT multiplexes, with different respondents highlighting five main areas: • self-retune costs (for the c. 11m viewers affected), given two retunes for some under hybrid soon after DSO; • professional assistance costs (new/changed aerials, other new receiving equipment) for up to 100,000 households; • extended communications and DSHS costs, into 2014, including for vulnerable and elderly people; • loss of commercial multiplex coverage for tens of thousands of households; and • loss of platform confidence due to repeated retunes, which one respondent proposed required a specific new study.	We discuss our assessment of viewer impact costs in paragraphs A2.62-A2.71 in the impact assessment.

Broadcasters and multiplex operators also stated that DTT provider costs had been understated in four key areas: • DSO programme risk; • planning and design resource for the new programme; • broadcaster management effort; and • post-DSO opex (e.g. RBL replacement lines).	See paragraphs A2.74-A2.78 in the impact assessment.
The BBC suggested that sufficiently reliable cost estimates could only be prepared when detailed site planning had been completed.	We agree that the absolute cost and spend profile of the clearance programme cannot be confirmed until planning work is completed. However we do think the cost range presented is appropriate for the purposes of the decisions made in the statement. See paragraph 4.106.
BT said that we had not addressed the case for regulatory measures (e.g. caps and mandated roaming) that may address competition issues.	We will address any obligations and measures that we place in the new licences as we take forward the award of the 800 MHz band following the conclusion of the Digital Britain process.
Digital UK said that there was a high risk that international negotiations for all sites will take longer than assumed in the base case. It also suggested we need to match up the likely timeline for international negotiations to complete (2010) with the rest of the timetable. It further indicated that it was unlikely that changes to frequencies will be completed by 2013 and that it was safer to assume 2014. Digital UK would need to oversee and coordinate both DSO and 800 MHz clearance, alongside Arqiva which would deliver in an overlapping timetable.	In section 6, we set out the timetable for how we expect international negotiations will progress alongside the DTT clearance programme. We anticipate that early decisions may be needed before international agreements are ratified. We set out in paragraph 4.64 that completing the DTT clearance programme by the end of 2013 will be challenging, but we consider it to be credible. We agree that there will be a need to coordinate this programme of work with Digital UK and set out in paragraph 4.76 how we will work with it on our implementation plans.
The BBC also suggested the impact assessment did not address the negative impact on the value of a seventh multiplex for new DTT services.	We took account of the effect of reduced coverage of any new additional multiplexes using the digital dividend spectrum in our consultation. No further information was provided to us to that caused us to update our estimates for the impact assessment.

Intellect agreed with our assessment of key impacts but suggested that the following should also be assessed. • Intellect suggested wireless microphones use 200 kHz in total at the moment which provides the scope for up to 40 concurrent (but independent) communications paths per TV channel, taking into account the need for sufficient filtering to achieve this level of utilisation. Intellect argued that 40 is a very significant number considering the very short range these devices are required to operate over and would indicate a very high number of devices could be deployed in a very small number of TV channels. • Intellect also claimed that it was not clear how we had calculated the extra cost of using unharmonised spectrum. Intellect felt that our analysis implied equipment costs would be higher. In reality it was more likely that standard terminals would be used, implying service would be restricted in the areas where channels 61 and/or 62 are used (assuming interference to PMSE in channel 69 can be avoided). This would reduce the spectrum value. • Intellect claimed that with all four options it would also be necessary to consider the possibility of terminals transmitting in an FDD downlink band. They can interfere if in close proximity to a reception terminal. Intellect went on to explain that although CEPT did not recommend such deployment, our policy did not bar it. Interference would also impact consumer benefits. In the same way that clearing channels 61, 62 and 69 increased economic benefit, so also would harmonising the transmit/receive bands. This did not alter the technology neutrality approach since HUPA, LTE and Wimax could all be used.	Intellect overestimates the current ability of wireless microphones to deploy in an 8 MHz channel of spectrum. We consider that a standard 10 mW (hand held) device can be assigned at an occupancy rate in the region of somewhat – but not five times – more than eight per channel. We are aware that there may be potential for using interleaved spectrum above and beyond that needed by PMSE users for other services. As a result, we are in the process of establishing a band manager which will have an incentive to promote efficient PMSE use of interleaved spectrum with a view to facilitating any non-PMSE demand (subject to its meeting its obligations to the sector). See paragraphs A2.58-A2.59 in the impact assessment for our calculation of the cost of using unharmonised spectrum. We did not need to harmonise transmit/receive bands in the 800 MHz band in order to reach the conclusion that clearing channels 61, 62 and 69 was in the interests of citizens and consumers. The packages to be offered will be considered as the process for awarding the band moves forward.
Intellect considered that a further significant benefit of enabling an 800 MHz mobile band (additional to the reduced energy costs) is a reduction in carbon emissions resulting from far fewer base stations being needed.	See paragraph A2.61 in the impact assessment.

BEIRG stated that 863-865 MHz is a harmonised EU band. New channel 69 services should not cause interference with applications operated in this band.	We understand that transmissions by mobile terminal stations in channel 69 may result in an increase in the levels of harmful interference into frequencies above 862 MHz in certain geometries and scenarios. However, it is expected that such scenarios will be transient in nature and will not materially impact the operation of short-range devices in the 863-865 MHz band.
One private individual said that the analysis did not appear to have considered the effect on communal aerial systems, which are often used in blocks of flats. Some of these use channel filters in order to equalise channel levels and/or prevent interference. These will, at the minimum, require retuning by a technician. In some cases they may require replacement. This problem is likely to arise with DSO in any case. If, however, the channels are moved again post-DSO then more or less the same problem could occur a second time.	We have revised our cost estimates to take communal aerials into account. See paragraph A2.68 and in particular footnote 52 in the impact assessment.
One private individual queried the impact on consumers with iDTVs.	Our analysis of retuning impacts applies to all digital receivers in affected households. This includes set top boxes and iDTVs.
One private individual suggested the environmental impact of disposing of channel 69 equipment should be considered.	See paragraph A2.87 of the impact assessment.
One respondent (on a confidential basis) asked for the impact on use of equipment currently being used in channel 70 to be assessed.	See paragraph A2.87 of the impact assessment.
Several individual PMSE respondents said that the value of channel 70 equipment which tunes to channel 69 should be taken into account as its value will decrease if channel 69 is no longer available. The costs of producing channel 70 equipment will increase as a result of this decision. Use of channel 70 equipment in channel 69 contributes to the level of unlicensed use of channel 69 by users who may not be aware of need for a licence. Increased use of channel 70 will lead to congestion.	Channel 70 will remain available for PMSE users. At this stage, we do not know whether demand for channel 70 equipment will increase or decrease. This is because we cannot anticipate how users will react to market signals given to them by the band manager as they make the transition to a market based approach to spectrum. We are also looking into the possibility of promoting more widespread use of channel 70 for PMSE. In terms of unlicensed use of spectrum, we recently embarked on a programme of engagement with representatives of community users who may be unaware of the need to hold a licence. Developing this engagement and the commercial incentive for the band manager to educate PMSE users should improve the current unlicensed situation.
RNID asked for consideration of the impact of proposals on audio induction loop systems.	See paragraph A2.86 of the impact assessment.

The BBC and C4 suggested that a full impact assessment should be completed once clarity on the programme and changes required had been established.	Further clarity on the DTT clearance programme will be provided when we publish our plans for implementation. We note at paragraph A2.6 of the impact assessment that our implementation decisions may have different implications and effects on different stakeholders. We would expect to undertake further impact assessments to assess these distributional consequences at a later date.
Possible consumer issues	
S4C, Five, the BBC and one other respondent (who wished to remain anonymous) observed that the hybrid option requires the largest number of retunes by viewers.	We agree that the hybrid option will lead to a larger number of household retunes. However, it also involves the lowest number of aerial changes and, on balance, we believe that the hybrid option minimises consumer impacts to the greatest extent. See paragraphs A2.63-A2.71 in the impact assessment.
Some responders noted that retuning within a region or even by site may take place several times in addition to DSO.	See paragraph A2.63 of the impact assessment.
The Isle of Man Communications Commission enquired whether viewers on the Isle of Man would be required to purchase new aerials, following DSO, as a result of revisions to the UK DSO plan. It also asked whether there would be any additional tuning required as a consequence of revisions to the UK plan or detrimental impact upon coverage.	We are unable to assess the impact of aerial changes and the extent of retunes to viewers in the Isle of Man until the frequency plans have been finalised, although we note that these frequencies are in use there. We will, however, keep the Isle of Man Communications Commission informed about the resulting impacts of these plans as decisions are taken.
The BBC suggested that costs to viewers ought to be taken into account, for example, the cost of purchasing and installing new receiving equipment, reorienting aerials or for installers to retune televisions or set top boxes. In particular the difficulties of vulnerable people who are currently receiving help from the DSHS should not be underestimated.	As set out above, we address viewer impact in paragraphs A2.63-A2.71 in the impact assessment. We do not believe that we have underestimated the difficulties of vulnerable viewers. We discuss this point in detail in paragraphs 4.119-4.135.
Intellect wanted to ensure that viewers receive sufficient information about the need to retune their sets and was concerned that as many as 100,000 households may require new TV aerials.	See paragraphs 4.37 and 4.119-4.121.
S4C suggested that a fund should be made available to rectify the situation in cases of viewers that had reception after DSO and then lost it after 800 MHz clearance changes. The BBC felt that where an impact on reception is unavoidable then consumers should be compensated with a new aerial.	Our plans take account of an assistance programme to support vulnerable viewers and this is included in our cost profile. We cannot yet comment on proposals for funding to be paid as we will not be able to draw conclusions until the technical plan is finalised. See paragraph 4.18.

Five asked for communications messages to make clear to consumers that any loss of coverage is a result of the spectrum reorganisation for clearance and not due to broadcasters' decisions.	See paragraph 4.133.
Five anticipated that commercial multiplexes would be differentially affected, with tens of thousands of households potentially impacted.	See paragraph A2.70 in the impact assessment.
In view of the inevitable need to retune set top boxes and iDTVs, RNID suggested that we should work to raise awareness of retuning amongst consumers, especially people with disabilities and other vulnerable groups.	See paragraphs 4.40 and 4.135.