Strategic advice to the telecommunications industry

Case studies for the award of the 700MHz/800MHz band: UK

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Contents

Please note: This document is one of a series of case studies on approaches to awarding the 700MHz/800MHz band[1] for mobile broadband. The countries in this series are Australia, Finland, Germany, Mexico, and UK. Each case study is available as a separate document.[2]

[1] Across the world, two harmonised UHF bands have been identified for mobile broadband: the 800MHz band (790–862MHz) in ITU region 1 (Europe and Africa) and the 700MHz band (698–806MHz) in the rest of the world.
[2] The case studies, plus a summary document plus presentation, are available for download from the GSMA website at **http://www.gsmworld.com/our-work/public-policy/spectrum/digital-dividend/**

1 United Kingdom: Summary

The UK government was arguably the first European government to consider the scope for using some of the digital dividend for services other than additional television channels. As early as 2003, the UK government identified the scope for 14 8MHz channels (in three separate blocks) to be made available for new uses, including the provision of mobile services, although uncertainties over the feasibility of this meant that the government was unable to precisely quantify this potential benefit.

However, the UK has not maintained this initial lead. The digital dividend band has still not been awarded at the time of writing. Indeed, shortly before this case study was completed, Ofcom (the telecoms regulator) announced a delay to the auction, which is not now expected before the final quarter of 2012. During the 10 years between 2003 and 2012, Ofcom will have published a very large quantity of technical material on this subject. It has consulted extensively and widely. Together with other branches of the UK government, it has carried out numerous, extensive and detailed studies into the costs and benefits of awarding the digital dividend band for telecoms use. Notwithstanding that extensive consultation and study, the UK has not escaped from the need (which occurs in every country going through this process) for political involvement to maintain momentum and to deal with disagreements among sector players, and with the impact of unexpected external events.

Regarding regional harmonisation, the UK's early start in studying this subject led to it carrying out work on alternative band and channel plans in parallel with the work on band and channel plans being done at the European and worldwide levels. This may have led to duplicated effort during the period 2003-2007, and to the UK being a relatively late adopter of the European harmonised approach which involved allocating the 790-862MHz band (the 800 MHz band) to electronic communications services.

The UK process has been characterised by several studies to estimate the benefits and costs of the digital switchover and of the re-purposing of the digital dividend band:

- In 2003, a cost benefit analysis indicated a net benefit in the range GBP1.5 and GBP2 billion in net present value (NPV) terms. The case was primarily made on the cost savings that would result from the switch-off of the analogue infrastructure compared to maintaining dual transmission systems.
- In 2005, the NPV was revised to a range of GBP1.1 to 2.2 billion, on the assumption that the spectrum would be used for two, additional standard-definition television multiplexes.
- In 2006, Ofcom's "Digital Dividend Review" estimated that the value of the digital dividend spectrum would lie within the range GBP5–10 billion (net present value over 20 years). This was based on considering a wide range of potential alternative uses of the released spectrum, including use for mobile broadband and additional television channels (both standard definition and high definition).
- In 2009, a further analysis was undertaken, specifically on the additional benefits/costs of adopting the 800MHz band in the UK, which resulted in an NPV in the range GBP2 to 3 billion, after accounting for the costs of migrating existing users (broadcast television from channels 61 and 62, programme making and special events from channel 69).

Over the period 2007-2009, it became increasingly clear that several European countries were exploring the possibility of creating a 790–862MHz band (the 800MHz band), which could potentially be used for the deployment of mobile broadband networks. Consequently, Ofcom proposed to modify its proposals to also create this band as part of its digital dividend (thus harmonising with Europe), but noting this would necessitate moving the planned broadcasting transmissions from channels 61 and 62 (primarily to channels 39 and 40) and programme making and special events (primarily wireless microphones) from channel 69 to channel 38. The UK government confirmed its commitment to fund these costs (estimated to be GBP115–250 million in net present value terms) in view of the far more significant net benefits of creating the 800MHz band.

Other costs estimated by Ofcom during the same period, include:

- Digital Switchover Help Scheme, which would provide support to older and disabled people in relation to installing and using the equipment required to receive digital television, of approximately GBP600 million

- Costs of interference mitigating measures, including the deployment of filters (in households as well as at mobile base stations), reorientation of aerials and, in the worst cases, migration of users from digital terrestrial television (DTT) to alternative platforms (e.g. satellite and cable) of GBP100 million
- Costs of re-planning of the frequency assignments such that channels 61 and 62 were replaced by assignments in other channels (primarily channels 39 and 40), of between GBP85 million and GBP185 million.
- Costs of clearing wireless microphone use from channel 69 (primarily purchasing replacement radio microphone equipment capable of operating in channel 38 for 1700 licensed users), in the range of GBP5–18 million.

2 United Kingdom: Detailed case study

2.1 Overview of process adopted by the regulator

As early as 2003, the UK government identified the possibility of some of the digital dividend (14 x 8MHz channels) being made available for alternative uses. In 2009, Ofcom announced proposals to revise its plans to incorporate the 790–862MHz band. Most recently, Ofcom has proposed to award the 800MHz spectrum by auction in the fourth quarter of 2012 (along with the 2.6GHz band).

Figure 2.1 below, provides a timeline of the main events that are of greatest relevance to the creation (and planned release) of the 800MHz band.

Figure 2.1: Summary of major events associated with the 800MHz band in the UK

Year	Event
1999	UK government announces plans for achieving switchover between 2006 and 2010. Government, industry and consumer groups begin development of the Digital Action Plan
2003	UK government endorses recommendations by Spectrum Planning Group under the Digital Action Plan, which indicated that the target of 6 national DTT multiplexes could be met and 14 channels of 8MHz each released (in three separate blocks) for other uses [1]
2004	Ofcom publishes its report on driving digital switchover [2], which indicates the UK's stance in forthcoming international conferences will be to seek greatest flexibility in the use of the cleared spectrum after switch-off
2005	Ofcom publishes implementation plan for UK switchover [3] – to be undertaken on a regional basis between 2007 and 2012
2005	Government confirms go-ahead for digital switchover in the UK
2006	Regional Radiocommunications Conference held to finalise frequency assignments during and following digital switchover
2007	Ofcom publishes outcome of its "Digital Dividend Review" [4], where it proposes to award 112 MHz of 'cleared spectrum' (channels 31–37, 39–40 and 63–68) on a service and technology neutral basis through an auction in the second half of 2008
2007	Digital switchover begins
2009	Proposals published by Ofcom to revise its plans for digital dividend in line with other European countries, leading to creation of the 800MHz band (790–862MHz) [5]
2009-2010	The Interim Digital Britain Report published in January identified that the UK had reached an impasse, preventing the release of additional spectrum for mobile services. The government proposed: • the creation of an Independent Spectrum Broker (ISB) targeted with reaching an industry agreed consensus on spectrum liberalisation • direction to Ofcom to (amongst other matters) conduct a combined auction of the 2.6GHz and 800MHz bands [6] The Direction had to be revised just before publishing to take into account the unexpected Orange/T-Mobile proposal to merge. The dissolution of Parliament on 12 March 2010 prevented the Direction from being issued: it was re-issued by the incoming government later in the year, in a simplified form (leaving to Ofcom's discretion decisions regarding spectrum caps and geographic coverage obligations). [17]
2010	European Commission adopts Decision which harmonises the technical conditions for the availability and efficient use of the 800MHz band
2011	Publication of Ofcom's most recent proposals for the award of the 800MHz band [7]

Year	Event
	UK Parliament Commons Select Committee hearings on Spectrum including the proposed 800MHz/2.6GHz auction
2012	Current proposed timing for auction of 800MHz and 2.6GHz spectrum bands (fourth quarter)
	Digital switchover expected to be completed
2013	800MHz band expected to be available for use

The 2003 plan [1] envisaged a digital dividend comprising two 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).

Ofcom's Statement of December 2007 [4] brought Channels 61 and 62 into the upper band, but it still differed from the harmonised approach finally adopted in Europe in a number of respects. In the 2007 Statement:

- Ofcom did not include Channel 69 in the frequencies to be awarded; this channel was to continue to be used for programme making and special events (PMSE)
- Ofcom 's approach was 'technology neutral', so in theory channels 61-68 could be used for applications other than wireless mobile broadband
- Channels 61 and 62 were not going to be available everywhere in the UK.

Ofcom was of course aware that the European Conference of Postal and Telecommunications Administrations (CEPT) was on the point of recommending a harmonised sub-band for mobile communications using channels 62-69 (798-862 MHz). [4, Page 21]. Ofcom also acknowledged that the outcome of the World Radio Conference in 2007 (WRC-07) included a primary mobile allocation for 790-862 MHz (channels 61-69). Notwithstanding these international developments, Ofcom decided to press ahead with its recommendations, which had been carefully crafted during (and before) the consultation to suit the UK situation. In 2007 Ofcom felt that this was the best way to award the spectrum without undue additional delays.

The events of 2009-10 in the table above (in which an attempt to break an 'impasse' in the spectrum negotiations was delayed by a change of government) are presented here to illustrate that, in spite of extensive consultation and study, the UK has not escaped from the need (which occurs in every country going through this process) for political involvement to maintain momentum and to deal with disagreements among sector players, and to deal with the impact of unexpected external events. There were several sets of events of this kind in the UK process; for reasons of space we have included only this one in the table.

One common characteristic of the UK government's approach throughout this process is to undertake public consultations at each stage that it announced major plans. In addition, the documents presented for the public consultation typically included a cost-benefit analysis of the government's/regulator's plans, and compared these to alternative options. All stakeholders (including individual citizens/TV viewers) were invited to comment on the plans leading to the next set of proposals. The above timeline and References section of this document only refer to the main consultation documents – many other consultation documents can be found at:

- http://www.digitaltelevision.gov.uk/publications/publication_home.html
- http://stakeholders.ofcom.org.uk/spectrum/project-pages/ddr/
- http://stakeholders.ofcom.org.uk/consultations/800mhz/.

2.2 Justification for clearance of the 800MHz band

Prior to proceeding with the implementation of major regulatory decisions, the UK government seeks to undertake cost benefit assessments to confirm the validity of each decision. This principle has been applied in the case of the digital switchover and also specifically in regard to the release of the 800MHz band.

In July 2003, the UK's first cost benefit analysis of digital switchover [8] indicated that the net benefit would amount to between GBP1.5 and GBP2 billion in net present value terms (from 2010 to 2026). At this stage, the primary driver of the overall benefit assessment was the cost savings that could be achieved from switch-off of the analogue infrastructure compared to maintaining dual transmission systems. This assessment noted that released spectrum could be used for mobile telecommunications services, and that in previous regulatory assessments of the economic value of spectrum, mobile telecoms generated greater benefits per MHz than television broadcasting. However, in view of the considerable uncertainties over whether the spectrum could/would be used for mobile services, the benefit assessment was based on the assumption that the 14 released channels would be used for digital television.

In February 2005, the UK government updated the above assessment [9] and identified the net benefits of switchover would lie within the range GBP1.1 to 2.2 billion for 2010–2015 switchover dates, with a net benefit amounting GBP1.7 billion if switchover were completed in 2012. Again, the assessment noted the potential use of the released spectrum for non-broadcast TV services (e.g. mobile) but for the purposes of calculating the benefits, it was assumed that the spectrum would be used for two, additional standard-definition television multiplexes.

In December 2006, Ofcom published the outcome of its "Digital Dividend Review" [4]. This estimated that the value of the digital dividend spectrum would lie within the range GBP5–10 billion (net present value over 20 years). This was based on considering a wide range of potential alternative uses of the released spectrum, including use for mobile broadband and additional television channels (both standard definition and high definition). As well as the quantifiable private value of the spectrum, the work also considered the wider societal benefits from different potential uses of the spectrum, in particular from television, but noted that many of these benefits could be delivered through the planned six national multiplexes or through alternative delivery mechanisms (e.g. TV could be delivered through broadband connections or satellite). Overall, Ofcom concluded that whilst it was clear that the digital dividend would generate significant benefits for the UK economy, there was huge uncertainty in relation to the value of individual uses. Consequently, Ofcom proposed to award the spectrum using a service and technology neutral approach in order to allow the market to determine the most economically efficient use of the spectrum.

In February 2009, Ofcom published a consultation on its proposals to align its digital dividend with the wider European plans for the creation of the 790–862MHz band (the 800MHz band) [5], which could be used for mobile broadband services. The consultation included a cost benefit analysis which indicated that the net benefits of this change would amount to GBP2 to 3 billion in net present value terms, after accounting for the costs of migrating existing users (broadcast television from channels 61 and 62, programme making and special events from channel 69). On the basis of this assessment, Ofcom proposed the creation of the 800MHz band and this has remained the UK government's policy since this point.

A final cost-benefit study done by Ofcom is worth mentioning, though it does not relate to the 'cleared' digital dividend spectrum to be awarded, but instead to a rearrangement of the spectrum occupied by DTT. In 2008, Ofcom estimated the benefits of a migration from the current DTT broadcasting standards (DVB-T combined with MPEG-2) to a new technology combination (DVB-T2 and MPEG-4). The introduction of these two technologies could increase the capacity of a multiplex by up to 160%,[3] enabling more standard definition channels per multiplex, or higher definition channels, or both. Viewers can only receive a DVB-T2/MPEG-4 signal if they buy suitable decoder or a television with such a built in decoder. Existing DVB-T/MPEG-2-capable TVs and decoders (in effect, the vast majority of all DTT receiving equipment in use at the time of writing) cannot pick up the new signal. Even so, Ofcom's modelling suggested that the NPV of the benefits to consumers of an accelerated migration to this new technology could be in the region of GBP3-5 billion (over 25 years). [24] The significance of this modelling for this case study is that its benefits were calculated entirely without reference to mobile telecoms. In the modelling, the benefits mainly arose out of two sources:

- additional consumer surplus as a result of there being more broadcasting capacity.
- with the new technologies, DDT is expected to lose market share to other digital television platforms (satellite, cable and similar) more slowly than it would without the new technologies. The resulting gains in revenues are significantly greater than the corresponding costs of rolling out the technologies.

This modelling is impossible to appraise fully because parts of the calculation were kept confidential. However it illustrates that significant NPVs can arise out of cost-benefit analyses involving uses other than mobile communications.

[3] Source: [24], Page 6.

2.3 Obstacles faced during band clearance

Implementation of the 800MHz band posed a number of challenges, many of which were common to the planned digital switchover process, without which the 800MHz band could not be released. In this section we discuss several of these challenges, as well as the UK government's approach to overcoming such challenges.

2.3.1 Adoption of set-top boxes

In 2003, the UK government identified that there were potential barriers to universal adoption of the set-top boxes that are required to enable viewers with analogue televisions to decode and watch digital TV channels. Whilst some of the barriers related to the cost of set-top boxes, the main concern was in relation to the usability of set-top boxes by individuals with certain issues (called 'capability losses' in UK government parlance). The concern was that such individuals could be excluded, in practice, from using digital television. A study commissioned by the UK government in 2003 [10] indicated that "The types of [issues] that could give rise to exclusion include reduced dexterity, impaired vision and hearing and impaired cognitive functioning." And that "These types of [issues] are evident amongst the disabled and elderly."

After several further studies and policy papers (see www.digitaltelevision.gov.uk for further details), in December 2006, the UK government announced secured funding of GBP600 million for the Digital Switchover Help Scheme (DSHS) [11], which would provide support to install and use the equipment required to convert an analogue television set to digital, and would be free to older and disabled people who received income-related benefits, and available to other older and disabled people at a subsidised fee of GBP40. The DSHS is being administered by the BBC, funded through the BBC licence fee. Detailed terms of the agreement have been published, the latest version is dated December 2009 [12].

2.3.2 Roof-top aerials

One objective of the spectrum planning process undertaken in preparation for the introduction of DTT was to minimise the number of households that had to make changes to their rooftop aerials. Many households have antenna equipment which operate only over part of the UHF television band (that which is relevant to the channels needed for analogue television reception), and therefore, to avoid the need for antenna replacement, the channels used for transmission of the DTT multiplexes would need to lie within the existing analogue range of frequencies. For this reason, the spectrum planning process resulted in the release of 14 channels for other uses [1] – if rooftop aerials had not be an issue, an alternative frequency planning approach could have been used that would have released 20 channels (in one contiguous block) for new uses.

2.3.3 Clearing DTT from channels 61 and 62

The creation of the 800MHz band required re-planning of the frequency assignments such that channels 61 and 62 were replaced by assignments in other channels (primarily channels 39 and 40). In its proposals for the creation of the 800MHz band [5], Ofcom estimated the cost of this would range between GBP85 million and GBP185 million. In the final Digital Britain report [13], the UK government indicated its commitment to fund the costs of clearing the 800MHz band (estimated total cost of GBP115–250 million in net present value terms).

2.3.4 Clearing wireless microphone use from channel 69

Channel 69 is the only channel in the UHF band that has been available on a UK-wide basis for wireless microphone users. As part of its plans for the creation of the 800MHz band [5], Ofcom proposed to make channel 38, which had previously been allocated for aeronautical radar use, available to these users following digital switchover, and estimated the cost of this (primarily purchasing replacement radio microphone equipment capable of operating in channel 38 for the 1700 licensed users) would be in the range of GBP5–18 million. As for channel 61 and 62 clearance, the UK government committed to funding these costs in its final Digital Britain report [13].

As with many aspects of the award process in the UK, the issue of wireless microphones, along with other programme making and special events (PMSE) devices, has been subject to extensive, detailed and repeated consultation:

- The Digital Dividend Review consultation of 2007 provoked 75 responses specifically on the subject of PMSE, and Ofcom commented that it had learned a lot from them [19]
- The issue of PMSE was then treated at length in a number of specific consultations:
  - 2007: "Programme making and special events: future spectrum access" [19]
  - 2008: "Consultation: Digital Dividend Review, band manager award" [20]
  - 2008: "Statement: Access to interleaved spectrum for programme-making and special events after digital switchover" [21]
  - 2009: "Consultation: Digital dividend, band manager award Second consultation" [22]
  - 2010: "Statement: Programme-making and special events: Future spectrum access" [23]

Each of the above were substantial and detailed consultations dealing with different aspects of the questions of PSME use of UHF spectrum after analogue switch-off. At each step in the process the regulator and the industry advanced in their appreciation of the others' proposals (the industry favoured the status quo, whereas the regulator wanted to promote economically efficient use of the spectrum, with applications such as PMSE moving bands if necessary in response to market-based spectrum prices). This somewhat iterative and detailed consultation process is not over at the time of writing. The need to provide a stable spectrum licensing environment for the Olympic Games has caused Ofcom to proposal delaying the implementation of some of its proposals (for example, for a 'band manager' to act as an economic intermediary between the government and PMSE users).

2.4 Protection of other/neighbouring spectrum uses

2.4.1 Interference to DTT

As a result of the adjacency (in frequency terms) between the 800MHz band and the spectrum used to transmit/receive DTT, there is a risk of interference from mobile base stations to the reception of DTT. Ofcom undertook investigations into the potential magnitude of this problem, and has proposed the establishment of a body to manage the implementation of mitigating measures [14]. These measures could include the deployment of filters for DTT household receivers, filters at mobile base stations, reorientation of aerials, reduction in the power levels produced by mobile base stations and (in a few cases) migrating users from DTT to other digital platforms (e.g. satellite and cable TV). Ofcom estimates that these measures could total around GBP100 million, (including the set-up and operating costs of the implementation body) and proposes that such costs should be borne by the new licensees of the 800MHz spectrum.

2.4.2 Short-range devices

Ofcom has investigated the scope for interference between mobile terminals and a wide range of licence-exempt short range devices that operate in the 830-870MHz frequency range [15] and has concluded that the majority of interference issues are likely to be short-lived and, in any case, not significantly more than already exist. However, Ofcom has noted that one use of the band comprises social alarms for the vulnerable (e.g. elderly in sheltered accommodation) and plans to undertake specific research on these devices and what actions could be taken to mitigate the interference e.g. moving such devices to other frequency bands, or making use of more robust signalling methods.

2.5 Award mechanism for the 800MHz band

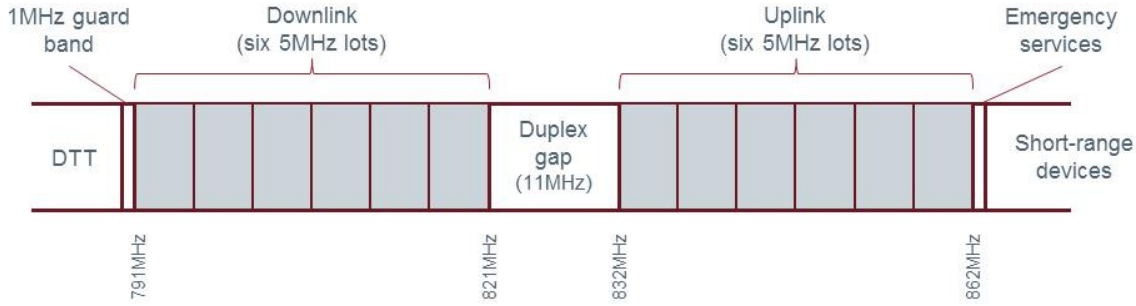
Ofcom's latest plans for the award of the 800MHz band were published in March 2011 [7], and included the following proposals:

- the 800MHz spectrum would be auctioned in combination with paired and unpaired spectrum at 2.6GHz
- the licences would be awarded on a service and technology neutral basis with infinite duration, but with an initial period of 20 years when Ofcom's powers to revoke the licence would be limited to specific circumstances
- the 800MHz band spectrum would be packaged in blocks of 2x5MHz
- operators could bid for a maximum of 2x27.5MHz of sub-1GHz spectrum (comprising both 800MHz spectrum won in the auction and existing 900MHz spectrum holdings)
- the auction design would ensure that there are at least four holders of a minimum package of sub-1GHz spectrum and 1800MHz/2.6GHz spectrum at the end of the auction

- one of the blocks would include an obligation for the winner to provide mobile broadband coverage at a rate of 2Mbit/s across the area in which 95% of the UK's population lives.

Figure 2.2, below illustrates the 800MHz band plan as it will be awarded in the UK. To be consistent with the European Commission's 800MHz Decision, it has a 1MHz guard band below the band (between the 800MHz band and DTT) and an 11MHz duplex gap.

Figure 2.2: Proposed 800MHz band plan



Ofcom is currently considering responses it has received to the above proposals, including submissions from politicians in the UK. Ofcom was until recently expecting to publish its final decision on the award process in autumn 2011 but has now announced that it expects to undertake a further round of consultation, leading to the auction process commencing in the fourth quarter of 2012.

2.6 References

[1] Department of Trade & Industry/Department of Culture, Media and Sport (January 2003), "Statement of the principles for planning the use of the UHF spectrum once analogue terrestrial television transmissions end"

[2] Ofcom (April 2004), "Driving Digital Switchover: A report to the Secretary of State".

[3] Ofcom (February 2005), "Ofcom spectrum management update: Technical planning for digital switchover around the UK".

[4] Ofcom (December 2007), "Digital Dividend Review: statement on our approach to awarding the digital dividend".

[5] Ofcom (June 2009) "Digital dividend: Clearing the 800MHz band".

[6] Department for Business, Innovation & Skills (October 2009), "Digital Britain Report: A Consultation on a Direction to Ofcom to Implement the Wireless Radio Spectrum Modernisation Programme".

[7] Ofcom (March 2011) "Consultation on assessment of future mobile competition and proposals for the award of 800MHz and 2.6GHz spectrum and related issues".

[8] UK government (July 2003) "Cost benefit analysis (CBA) of digital switchover".

[9] Department of Culture, Media and Sport/Department of Trade & Industry (2005), "DCMS/DTI Memorandum – the Costs and Benefits of Digital Switchover".

[10] Department of Trade & Industry in association with The Generics Group (September 2003), "Digital Television for All: A report on usability and accessible design".

[11] Department for Culture, Media and Sport (December 2006), "Digital Switchover Help Scheme".

[12] Document Reference CM771 (December 2009), "Scheme agreement between Her Majesty's Secretary of State for Culture, Media and Support and the British Broadcasting Corporation".

[13] Department for Business Innovation & Skills and Department of Culture, Media and Sport (June 2009), "Digital Britain: Final Report".

[14] Ofcom (June 2011) "Coexistence of new services in the 800MHz band with digital terrestrial television".

[15] Ofcom (June 2011) "Consultation and information on technical licence conditions for 800MHz and 2.6GHz spectrum and related matters".

[16] BBC News (Oct 2011) "Ofcom delays 4G mobile auctions".

[17] "Mobile Communications" snapshot of web site of UK Department of Business, Innovation & Skills, February 2009.

[18] European Commission (2007), "Communication: Reaping the full benefits of the digital dividend in Europe: A common approach to the use of the spectrum released by the digital switchover".

[19] Ofcom (2007), "Consultation: Programme-making and special events: future spectrum access".

[20] Ofcom, (2008), "Consultation: Digital Dividend Review, band manager award".

[21] Ofcom (2008), "Statement: Access to interleaved spectrum for programme-making and special events after digital switchover".

[22] Ofcom (2009), "Consultation: Digital dividend, band manager award Second consultation".

[23] Ofcom (2010), "Statement: Programme-making and special events: Future spectrum access".

[24] Ofcom (2007), "Consultation: The Future of Digital Terrestrial Television Enabling new services for viewers".

[25] Ofcom (2008), "Statement: Digital Television: Enabling New Services Facilitating efficiency on DTT".