The award of 800 MHz and 2.6 GHz spectrum

Information Memorandum

Publication date: 24 July 2012

Important Notice

This Information Memorandum (Memorandum) has been prepared by Ofcom in connection with the proposed award of Licences in the 800 MHz band, the 1800 MHz band and the 2.6 GHz band by auction. Terms and expressions used in this Memorandum are as defined in Annex 10 of this Memorandum, or in the text of the Memorandum itself.

The Award Process will be conducted in accordance with regulations to be made by Ofcom pursuant to powers under Section 14 of the Wireless Telegraphy Act 2006, pursuant to which the grant of the Licences may be made following a procedure set out in regulations issued by Ofcom.

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Contents

Section 1

Introduction

1.1 This Memorandum provides information for those parties considering bidding in this Award Process for a Wireless Telegraphy Act 2006 (WT Act)[1] licence to establish or use stations for wireless telegraphy or to install or use apparatus for wireless telegraphy in one or more of the 800 MHz, 1800 MHz and 2.6 GHz bands in the United Kingdom (UK) (referred to in this Memorandum as a Licence).

1.2 In particular, this Memorandum:

- describes the characteristics of the bands for which Licences are to be awarded;
- explains some factors that may affect Licensees' use of the bands;
- summarises some of the principal terms of the Licences that will be issued following completion of the Award Process, and provides at Annex 1 a draft template of the Licences that will be issued;
- sets out the spectrum lots that will be available in the Award Process and the Reserve Price for each lot;
- provides certain information in relation to the Award Process; and
- provides information on a range of other associated issues.

1.3 We intend to issue an update to this Memorandum towards the end of 2012. In particular, this update may include certain additional information relating to the 1800 MHz lot, if that lot is to be included in the Award Process as a result of the requirement on Everything Everywhere (EE) to divest the spectrum in the context of the European Commission's T-Mobile/Orange merger decision.

1.4 Certain terms used in this Memorandum are explained in the Glossary at Annex 10.

[1] http://www.legislation.gov.uk/ukpga/2006/36/contents

Section 2

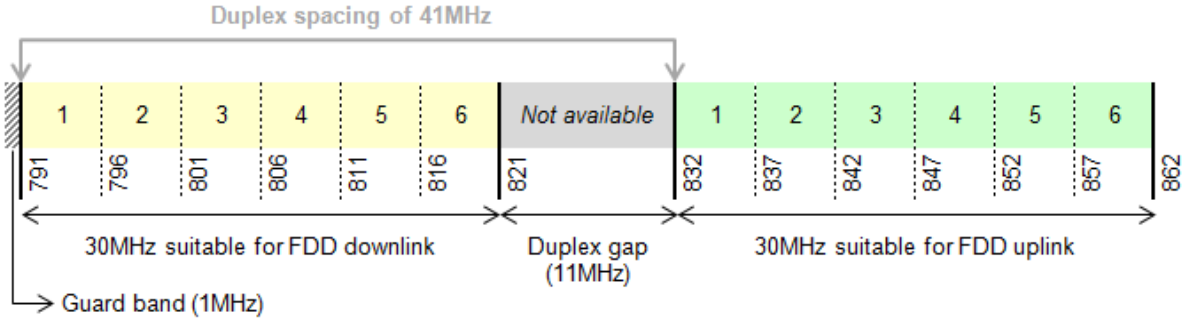
The spectrum bands

800 MHz

2.1 The availability of spectrum for award in the 800 MHz band (790 to 862 MHz) arises from the decision to clear the band of terrestrial television broadcasting and programme-making and special events (PMSE) use. The configuration of the spectrum has been determined by the 800 MHz Decision.[2] The 800 MHz Decision requires that when Member States make the 800 MHz band available for networks other than high power broadcasting networks they shall do so on a non-exclusive basis for terrestrial networks capable of providing electronic communications services. They must also do so in compliance with the parameters set out in the annex to the 800 MHz Decision.

2.2 The parameters set out in the annex to the 800 MHz Decision include the frequency arrangement in the band. The harmonised frequency arrangement is 2 x 30 MHz with a duplex gap of 11 MHz, based on a block size of 5 MHz, paired and with reverse duplex direction, and with a guard band of 1 MHz starting at 790 MHz. The Frequency Division Duplex (FDD) downlink starts at 791 MHz and FDD uplink starts at 832 MHz. This is illustrated by Figure 2.1 below.

Figure 2.1: Frequency arrangement in the 800 MHz band



2.3 We discuss in section 6 how we propose to package the 800 MHz spectrum for the Award Process.

2.4 The centre gap from 821 to 832 MHz is not being awarded in this Award Process. Ofcom intends to consider separately and at a later stage what uses might be appropriate for this part of the band and how to make it available.

1800 MHz

2.5 The availability of spectrum for award in the 1800 MHz band (1710 to 1781.7 MHz paired with 1805 to 1876.7 MHz) depends on whether EE concludes a private sale of the rights to this spectrum, including approval from the European Commission and Ofcom, within the timeframe specified in the commitments provided by France

[2] European Commission Decision of 6 May 2010 on harmonised technical conditions of use of the 790 to 862 MHz band for terrestrial systems capable of providing electronic communications services in the European Union (2010/267/EC) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:117:0095:0101:EN:PDF

Télécom and Deutsche Telekom to the European Commission in the context of the T-Mobile/Orange merger decision (the Commitments).[3]

2.6 In the event that this spectrum is available in the Award Process, any party considering bidding for it should be aware that it will also need to be able to satisfy the test in the Commitments in order to be approved as a purchaser by the European Commission and Ofcom. The test is that the party must:

a) be independent of and unaffiliated to the Parties (as defined in the Commitments);

b) have the financial resources, proven expertise and incentive to use the spectrum as a viable and active competitive force in competition with the Parties (as defined in the Commitments) and other competitors; and

c) neither be likely to create, in the light of the information available to the European Commission, *prima facie* competition concerns nor give rise to a risk that the implementation of the Commitments will be delayed, and must, in particular, reasonably be expected to obtain all necessary approvals from the relevant regulatory authorities for the acquisition of the spectrum.

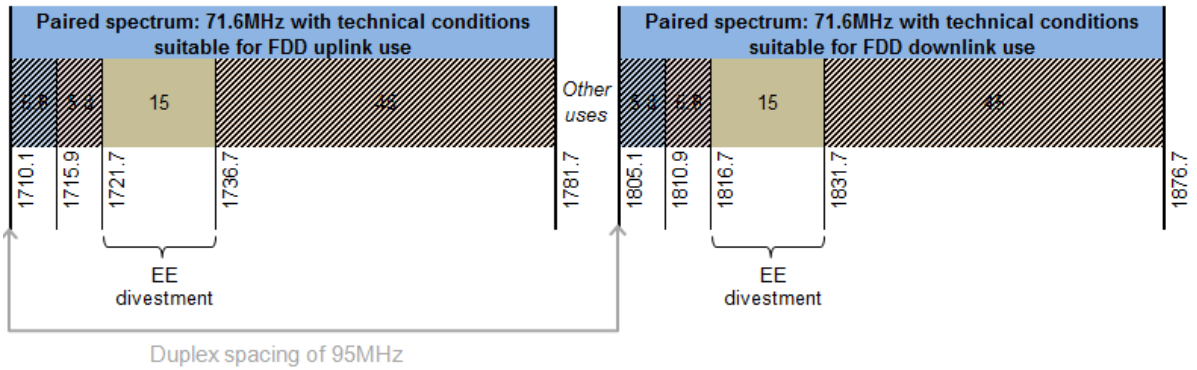
2.7 Ofcom's decision to qualify any person as a bidder in the Auction in accordance with the Regulations cannot be taken as deemed approval for the purposes of the Commitments, or as an indication that such approval will be given. If a Licensee awarded this spectrum in the 1800 MHz band during the Award Process is not approved for the purpose of the Commitments, Ofcom intends to revoke the relevant Licence (or vary the Licence to remove any rights in relation to the spectrum in the 1800 MHz band).

2.8 Parties should also be aware that the Commitments require EE to clear this spectrum in the 1800 MHz band, and surrender its licences to Ofcom by no later than 30 September 2013 (in relation to the frequencies 1721.7-1731.7 MHz and 1816.7-1826.7 MHz) and 30 September 2015 (in relation to the frequencies 1731.7-1736.7 MHz and 1826.7-1831.7 MHz). As a result, any Licence awarded by Ofcom in this band will only permit use of the relevant frequencies from after these dates.

2.9 Figure 2.2 below shows the current arrangement of the 1800 MHz band, identifying the spectrum EE is required to divest.

[3] European Commission Decision in case No. COMP/M.5650 – T-Mobile/Orange, dated March 2010 http://ec.europa.eu/competition/mergers/cases/decisions/M5650_20100301_20212_247214_EN.pdf

Figure 2.2: Frequency arrangement in the 1800 MHz band



2.10 Current assignments in the band are as follows:

- 1710.1-1715.9 MHz paired with 1805.1-1810.9 MHz: Telefónica
- 1715.9-1721.7 MHz paired with 1810.9-1816.7 MHz: Vodafone
- 1721.7-1781.7 MHz paired with 1816.7-1876.7 MHz: EE

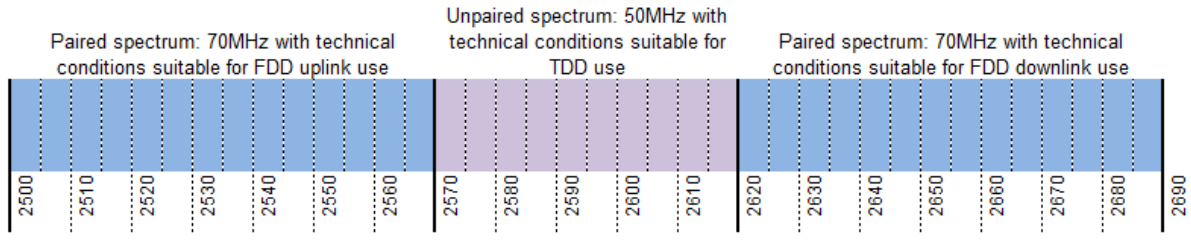
2.11 We discuss in section 6 how we propose to package the divested 1800 MHz spectrum should it become available in the Auction.

2.6 GHz

2.12 The 2.6 GHz Decision[4] required Member States to designate the 2.6 GHz band (2500 to 2690 MHz) within six months of the 2.6 GHz Decision's entry into force and subsequently make it available on a non-exclusive basis for terrestrial systems capable of providing electronic communications services, in compliance with a number of technical parameters set out in the annex to the 2.6 GHz Decision.

2.13 Figure 2.3 below illustrates the current arrangement of the 2.6 GHz band. It accords with the annex to the 2.6 GHz Decision, which defines conditions of use for 2500 to 2570 MHz paired with 2620 to 2690 MHz for Frequency Division Duplex (FDD) use and indicates that administrations may assign 2570 to 2620 MHz for Time Division Duplex (TDD) or other usage modes complying with the block edge mask.

Figure 2.3: Frequency arrangement in the 2.6 GHz band



[4] European Commission Decision of 13 June 2008 on the harmonisation of the 2500-2600 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community (2008/477/EC) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:163:0037:0041:EN:PDF

2.14 We discuss in section 6 how we propose to package the 2.6 GHz spectrum for the Award Process.

Allocations in and adjacent to the 800 MHz and 2.6 GHz bands

2.15 The section that follows includes information that we think may be useful to potential bidders, as it may show other existing or future uses in and adjacent to the 800 MHz and 2.6 GHz bands.

UK allocations adjacent to the 800 MHz band

Digital Terrestrial Television (DTT) below 790 MHz

2.16 The bands below 790 MHz are used for DTT. We explain in section 5 how co-existence of mobile services in the 800 MHz band with adjacent DTT use will be managed.

Emergency Services in the 862 to 863 MHz band

2.17 The frequency band from 862 to 863 MHz is available to emergency services and a number of systems are in use throughout the UK. We explain in section 3 how this may affect mobile services in the 800 MHz band.

Short Range Devices in the 863 to 870 MHz band

2.18 A number of Short Range Devices (SRDs) operate in the EU harmonised frequency band between 863 and 870 MHz. We explain in section 3 our conclusions on how these may be affected by mobile services in the 800 MHz band.

UK allocations within and adjacent to the 2.6 GHz band

2.19 Figure 2.4 below illustrates the current spectrum allocations within and adjacent to the 2.6 GHz band. The illustration is based on UKFAT, the current issue of which is 2010, Issue No. 16[5] (although this Figure does not include footnotes 5.403 and 5.420 to UKFAT).

2.20 The UKFAT is issued by the National Frequency Planning Group on behalf of the Cabinet Office Official Committee on UK Spectrum Strategy and details the uses to which various bands can be put in peacetime within the UK. The UKFAT covers both civilian and non-civilian uses of spectrum within the UK. It is updated from time to time in the light of spectrum policy decisions nationally and internationally. In addition, there is an Ofcom publication called the UK Plan for Frequency Authorisation, which deals with civilian uses only (and these are authorised by Ofcom by way of licence or licence exemption).[6]

2.21 The allocations in Figure 2.4 are identified in terms of primary and secondary services, the distinction defined in the Radio Regulations[7] of the ITU (which applies as between countries, but not as between licensees) being that stations of a

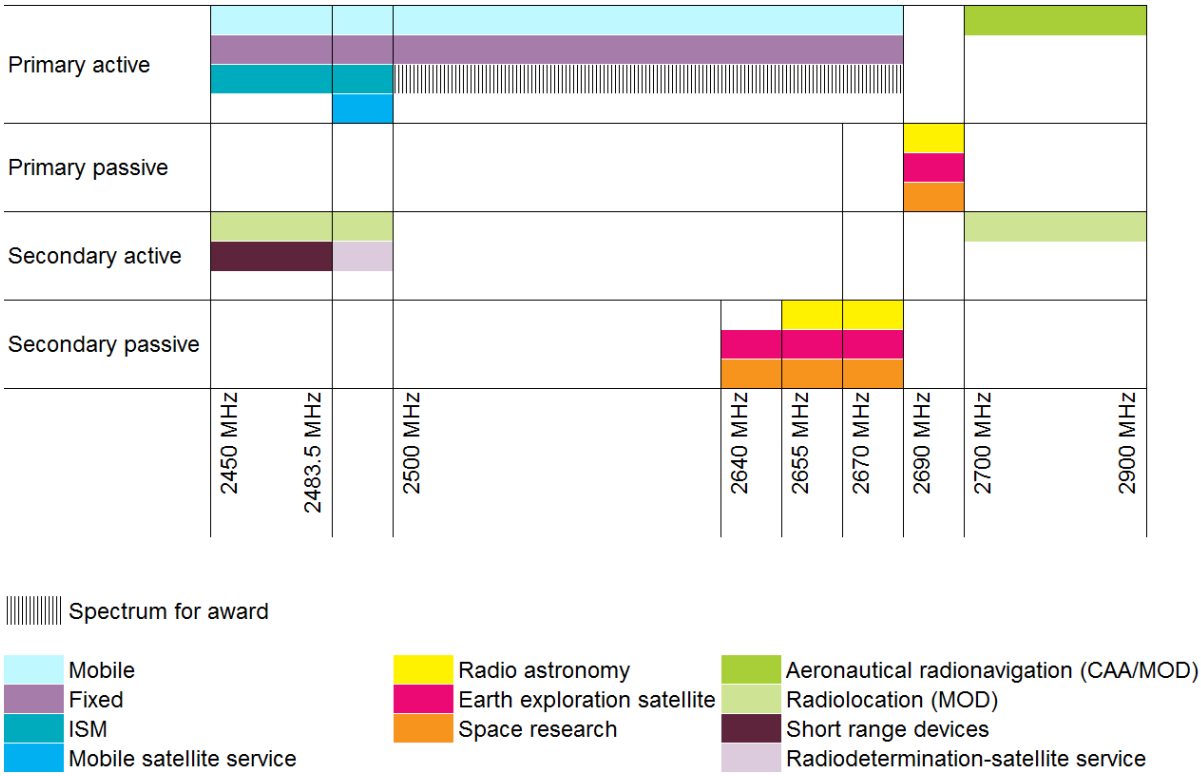
[5] http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/ukfat2010.pdf
[6] http://spectruminfo.ofcom.org.uk/spectrumInfo/ukpfa
[7] An international treaty published by the ITU, an agency of the United Nations - see http://www.itu.int and http://www.itu.int/opb/sector.aspx?lang=en&sector=1

secondary service shall not cause harmful interference to stations of primary services nor claim protection from harmful interference from stations of a primary service. However, stations of a secondary service can claim protection from harmful interference from stations of the same or other secondary service(s) that are assigned at a later date. The allocations are also identified within Figure 2.4 as active or passive services. Stations of passive services do not transmit; stations of active services may transmit and/or receive.

2.22 The UKFAT also identifies responsibilities for the management of frequency bands or services, showing whether they are managed by (or on behalf of) Ofcom or the MOD.

Figure 2.4: Service allocations for the 2.6 GHz band and adjacent spectrum

Based on FAT Issue No. 16 (2010)



Primary allocations in the 2.6 GHz band

2.23 Issue 16 of the UKFAT contains the following primary allocations in the 2.6 GHz band:

- Primary fixed service and mobile service allocations in the 2.6 GHz band, but with aeronautical mobile excluded from 2500 to 2520 MHz. Use of the 2.6 GHz band for PMSE falls under these service allocations; the 2.6 GHz band is due to be cleared of existing PMSE users so that Ofcom can grant new licences in accordance with the Award Process. PMSE includes wireless camera applications, mobile and portable point-to-point video links, and some airborne use. Some geographic and specific power restrictions apply. Short-term licences for use in the band are currently available but these licences can be revoked on three months' notice. This three months' notice will be triggered when we announce the provisional application date to participate in the Award Process. PMSE use of the band after revocation of the licences would be unlawful.

- There is a residual primary mobile satellite service allocation in the 2670 to 2690 MHz bands in the main frequency allocation table. However, the Radio Regulations 2008 no longer show the mobile-satellite service allocations and corresponding footnotes for ITU-R Region 1 (Europe, Africa, the Middle East and Mongolia) and Region 2 (the Americas) with effect from 1 January 2009. Therefore this allocation and the associated footnote 5.351A will be suppressed in the next issue of the UKFAT.

Secondary allocations in the 2.6 GHz band

2.24 The 2655 to 2690 MHz band is allocated in the UK to radio astronomy, Earth exploration satellite (passive) service and space research (passive) service on a secondary basis. All of these allocations are for passive services. Additionally, the 2640 to 2655 MHz band is allocated to the Earth exploration satellite (passive) service and space research (passive) service on a secondary basis through footnote 5.339.

2.25 Radio astronomy use of the 2655 to 2690 MHz band is assigned category D protection status within the UKFAT (i.e. no protection is afforded to the radio astronomy service in this band). The UKFAT lists the Jodrell Bank observatory as using the band for very long baseline interferometry and pulsar observations.

Primary allocations adjacent to the 2.6 GHz band

2.26 The 2450 to 2500 MHz band is allocated to fixed and mobile services on a primary basis. The mobile service allocation excludes aeronautical use. There is a primary allocation to the mobile satellite service (space to Earth) between 2483.5 and 2500 MHz which is used for active services.

2.27 The ITU World Radiocommunication Conference 2012 (WRC-12) added a primary allocation to the radiodetermination-satellite service (space to Earth) in 2483.5 to 2500 MHz. This allocation will become effective when the new version of the Radio Regulations enters into force, on 1 January 2013.

2.28 The 2690 to 2700 MHz band has primary allocations to three passive services: Earth exploration-satellite, radio astronomy and space research (passive). The 2700 to 2900 MHz band has a primary allocation to an active service, the aeronautical radionavigation service.

2.29 Primary allocations within the UK adjacent to the 2.6 GHz band are described in the following paragraphs.

Fixed and mobile services (2450 to 2500 MHz)

2.30 The 2450 to 2500 MHz band is used for PMSE. Access to the band for PMSE is managed on behalf of Ofcom by the JFMG and is typically used for point-to-point video links with a maximum ERP of 40 dBW. Some geographical restrictions apply. The Interface Requirements for PMSE use within the UK are set out in IR 2038[8].

2.31 The following categories of PMSE applications typically operate in the 2450 to 2500 MHz band:

[8] http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/ir2038.pdf

- temporary digital point-to-point video links (coordinated, with a maximum ERP of 40 dBW);
- airborne (air-to-ground) digital point-to-point video links (with a maximum ERP of 23 dBW). Such use is limited within the 2450 to 2490 MHz range; and
- wireless digital cameras (ERP nominally 0 dBW).

2.32 Further information on the technical frequency assignment criteria and principles employed by JFMG on behalf of Ofcom is provided at: http://www.ofcom.org.uk/radiocomms/ifi/glines/bas_cg/pmse.

Mobile satellite – Globalstar (2483.5 to 2500 MHz)

2.33 The primary allocation to the mobile satellite service in the 2483.5 to 2500 MHz band is used by the Globalstar system, which operates a space to Earth link in that band. Ofcom understands that Globalstar is the only mobile satellite services system currently operational within the band. It is identified as HIBLEO-4 in the ITU Space Radiocommunication Stations database and LEO-D in ITU-R Recommendation M.1184. The Globalstar mobile earth-station terminals are licence-exempt in the UK with the minimum performance requirements and technical characteristics specified in ETSI standard 300 733. The Interface Requirements for mobile earth-station terminals are set out in IR 2016[9].

Earth exploration-satellite service (2690 to 2700 MHz)

2.34 The UKFAT indicates that this band is allocated to the Earth exploration-satellite service on a primary basis as a passive service. Footnote 5.340 prohibits all emissions in the band (except in certain countries identified within Footnote 5.422).

Radio astronomy (2690 to 2700 MHz)

2.35 The UKFAT indicates that this band is allocated to the radio astronomy service on a primary basis as a passive service. Footnote 5.340 prohibits all emissions in the band (except in certain countries identified within Footnote 5.422). The band is covered under an RSA for the radio astronomy observatories located at Cambridge, Darnhall, Defford, Jodrell Bank, Knockin and Pickmere. This band is listed as being available for mapping radio sources, pulsars, and possibly MERLIN (Multi-Element Radio Linked Interferometer Network). Information from the UK radio astronomy community indicates that there is little current or planned observation in the band and that it is not a priority for UK radio astronomy use.

Space research (passive) (2690 to 2700 MHz)

2.36 The UKFAT indicates that this band is allocated to the space research (passive) service on a primary basis.

Aeronautical radionavigation and radiolocation (2700 to 2900 MHz)

2.37 The 2700 to 2900 MHz band has a primary allocation to the aeronautical radionavigation service and a secondary allocation to the radiolocation service. In the

[9] http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/IR2016final.pdf

UK the band is jointly managed by the Directorate of Airspace Policy of the CAA and by the MOD. It is extensively used for air traffic control (ATC) by National Air Traffic Services (NATS), by other organisations that operate airports and by the MOD operating at fixed locations and from designated training areas.

2.38 Some radars in the 2700 to 2900 MHz band, particularly the older magnetron or TWT types, may have significant out-of-band (OOB) or spurious emissions that can extend for many tens of MHz beyond their operating frequencies. If these radars operate on frequencies close to the 2700 MHz band edge, their emissions could extend into the top channels of the 2.6 GHz band.

2.39 Interface Requirement, IR 2050[10], notes that frequency planning assumptions for radars are in accordance with ITU Radio Regulations Appendix 3, Recommendation ITU-R SM. 329-10 (Unwanted emissions in the spurious domain) and Recommendation ITU-R SM.1541-2 (Unwanted emissions in the out-of-band domain). It should also be noted that currently there is no regulatory basis for limiting OOB emissions for ground-based military radar systems, the operational requirements of which are subject to change. Recently installed civil radar systems are subject to the requirements of the R&TTE Directive[11] and associated UK implementation instruments.

2.40 The following documents provide information on typical radar RF parameters, possible unwanted emission characteristics, and the different types of radar usage within the UK:

- "Study into spectrally efficient radar systems in the L and S bands." A report by BAE Systems Integrated Systems Technology Limited for the Ofcom Spectrum Efficiency Scheme, May 2006[12];
- "The report of an investigation into the characteristics, operation and protection requirements of civil aeronautical and civil maritime radar systems." A report by Alenia Marconi Systems Limited for the Radiocommunications Agency, August 2001[13];
- Recommendation ITU-R M.1461-1. Procedures for determining the potential for interference between radars operating in the radiodetermination service and systems in other services;
- Recommendation ITU-R M.1464-1. Characteristics of radiolocation radars, and characteristics and protection criteria for sharing studies for aeronautical radionavigation and meteorological radars in the radiodetermination service operating in the 2700-2900 MHz frequency band;
- Recommendation ITU-R SM 1541-4. Unwanted emissions in the out-of-band domain, Annex 8, OOB domain emission limits for primary radar systems; and

[10] http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/ir2050.pdf
[11] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity
[12] http://stakeholders.ofcom.org.uk/market-data-research/other/technology-research/research/spectrum-efficiency/sers/
[13] http://www.ofcom.org.uk/static/archive/ra/topics/research/topics/s-studies/civil-radio-systems.pdf

- Recommendation ITU-R SM 329-11. Unwanted emissions in the spurious domain.

2.41 The most recent information available on civil and military radars that operate in the range 2700-2790 MHz is included in the draft "Notice of coordination procedure required under spectrum access licences for the 2.6 GHz band", which is annexed to this Memorandum (Annex 3). Some information on possible interference mechanisms was included in chapter 8 of the Real Wireless report[14] "Low-power shared access to spectrum for mobile broadband", published alongside Ofcom's March 2011 consultation[15]. Interested parties should make their own assessment of the potential impact of unwanted emissions from radars on their intended use of the 2.6 GHz band.

Other allocations adjacent to the 2.6 GHz band

2.42 In the 2700 to 2900 MHz band, UKFAT identifies a secondary allocation to the radiolocation service. An additional allocation is limited to meteorological and military radar only (UK 97).

2.43 With respect to meteorological radars, the Met Office has indicated to Ofcom that they do not currently operate the UK weather radar network in the 2700 to 2900 MHz band, but may need to use this band in future subject to development of interference issues at their present frequency location.

2.44 The 2400 to 2483.5 MHz band is used for licence exempt wide band data transmission systems including Wireless Local Area Network (WLAN) based on the IEEE 802.11 and 802.15 standards (which include WiFi and Bluetooth). The maximum EIRP. for wide band data transmission systems is 20 dBm (100mW). The Interface Requirements for Wideband Transmission Systems are set out in IR 2030/7/1.

2.45 Additionally, the 2400 to 2483.5 MHz band is used in the UK for non-specific licence exempt short range devices operating 10mW effective isotropically radiated power (EIRP). The Interface Requirements for Non-Specific SRD 2400 to 2483.5 MHz are set out in IR 2030/1/22. However higher powers up to 500mW (outdoors) EIRP. and 4W (indoors) EIRP. is permitted within the sub-band 2446 to 2454 MHz for RFID. The Interface Requirements for RFID 2446 to 2454 MHz are set out in IR 2030/13/5 and IR2030/13/6.

2.46 Below 2500 MHz the spectrum is used by PMSE in the fixed and mobile service allocations at 2450 to 2500 MHz, wideband data transmission systems and short range devices[16] (2400 to 2483.5 MHz), and mobile satellite (2483.5 to 2500 MHz). The UKFAT also contains secondary allocations to the radiodetermination-satellite service.

2.47 Aeronautical radionavigation and radiolocation services operate in the 2700 to 3100 MHz band (the S-band). We explain in section 3 how this may affect the operation of mobile services in the 2.6 GHz band.

[14] http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/annexes/real-wireless-report.pdf
[15] http://stakeholders.ofcom.org.uk/consultations/combined-award/
[16] http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/IR_2030.pdf

International allocations and uses of the 800 MHz band

2.48 The Radio Regulations specify the following allocations in the 800 MHz band:

- a primary allocation to the mobile, except aeronautical mobile, service in ITU Region 1; until 16 June 2015 this allocation is effective in 64 countries of Region 1, including the UK, according to the conditions of footnotes 5.316 and 5.316A of the Radio Regulations. Following that date it is effective across the whole of Region 1; the Final Acts of the World Radiocommunication Conference 2012 (WRC-12) indicate that from 1 January 2013 there will be 80 countries in footnote 5.316 or 5.316A. In Regions 2 (except Brazil) and 3 there is a primary allocation to the mobile service;
- a primary allocation to the broadcasting service in all three ITU Regions;
- a primary allocation to the fixed service in ITU Regions 1 and 3 and a secondary allocation to this service in Region 2;
- a primary allocation to the aeronautical radionavigation service in the Russian Federation and parts of Eastern Europe;
- an additional secondary allocation to the land mobile service in the UK and six other countries; and
- a secondary allocation to the mobile-satellite, except aeronautical mobile-satellite (R), service in Belarus, the Russian Federation and Ukraine, subject to conditions in Radio Regulations footnote 5.319.

2.49 Additionally, footnote 5.317A to the Radio Regulations identifies those parts of the band 790-960 MHz in Regions 1 and 3, and 698-960 MHz in Region 2, which are allocated to the mobile service on a primary basis, for use by administrations wishing to implement International Mobile Telecommunications (IMT).

2.50 Border co-ordination between European administrations is considered in ECC Recommendation (11)04[17]. Amongst its recommendations are that co-ordination shall be based on bilateral or multilateral agreements between administrations. The Recommendation also provides field strength levels as a basis for co-ordination between Long Term Evolution (LTE) systems and a separate set of field strength levels for co-ordination between dissimilar systems.

France

2.51 There is currently no Memorandum of Understanding (MoU) covering the 800 MHz band between France and the UK. We have received proposals from France to consolidate other existing MoUs in a single document and add the 800 MHz band.

Ireland

2.52 The UK has recently entered into a MoU with Ireland covering the 800 MHz band. This is included in Annex 7 to this Memorandum. The technical parameters are in line with those in ECC Recommendation (11)04.

[17] http://www.erodocdb.dk/Docs/doc98/official/Word/REC1104.DOC

International allocations and uses adjacent to the 800 MHz band

2.53 The international allocations that apply immediately below 790 MHz in neighbouring countries are identical to those indicated within the UKFAT, except for some additional allocations affecting the Russian Federation and parts of Eastern Europe. WRC-12 additionally agreed Resolution 232 on the 694 to 790 MHz band. This resolves to allocate that band in Region 1 to the mobile, except aeronautical mobile, service on a co-primary basis with other services to which this band is allocated on a primary basis and to identify it for IMT, and that this allocation will come into effect immediately after the 2015 World Radiocommunication Conference (WRC-15). It additionally calls for a number of studies on the spectrum requirements of the mobile and the broadcasting services, and on coexistence between mobile and other services allocated in the band.

2.54 The Short Range Devices use of the spectrum above 863 MHz is harmonised across Europe.

International allocations and uses of the 2.6 GHz band

2.55 The Radio Regulations specify the following allocations in the 2.6 GHz band:

- primary allocations to the fixed and mobile (except aeronautical mobile) services in the whole of the 2.6 GHz band in all three ITU Regions;
- a primary allocation to the broadcasting-satellite service in the 2520 to 2670 MHz band in all three ITU Regions;
- secondary allocations to the earth exploration-satellite (passive) and space research (passive) services in the 2640 to 2690 MHz band;
- a secondary allocation to the radio astronomy service in the 2655 to 2690 MHz band; and
- further allocations applicable in Regions 2 and/or 3, but not Region 1.

2.56 The Radio Regulations also contain a primary allocation to the radiolocation service in France in the 2450 to 2550 MHz band under footnotes 5.397 and 5.405. WRC-12 agreed to remove these footnotes, so this allocation will no longer be effective from 1 January 2013, when the new Radio Regulations enter into force.

2.57 Additionally, footnote 5.384A of the Radio Regulations identifies the 2.6 GHz band for use by administrations wishing to implement IMT. The primary allocations listed in paragraph 2.55 are all for active services. There are also secondary allocations in the 2670 to 2690 MHz band in all three ITU regions for the Earth exploration-satellite, radio astronomy and space research services, all of which are passive services.

2.58 Border co-ordination between European administrations is considered in ECC Recommendation (11)05[18]. Amongst its recommendations are that co-ordination shall be based on bilateral or multilateral agreements between administrations. The Recommendation also provides field strength levels as a basis for co-ordination between FDD systems and between TDD systems, and specific guidance for border

[18] http://www.erodocdb.dk/Docs/doc98/official/Word/REC1105.DOC

co-ordination between LTE systems. For border co-ordination between UMTS systems, the older ERC Recommendation 01-01 (revised Helsinki 2007)[19] applies.

2.59 Harmonisation work within the ECC has produced the following Decisions relevant to the 2.6 GHz band (in addition to the 2.6 GHz Decision):

- ECC/DEC/(02)06[20] (November 2002) which designates the 2.6 GHz band to UMTS/IMT-2000 and the 2520 to 2670 MHz portion to terrestrial UMTS/IMT-2000. According to the Decision, the 2500 to 2690 MHz band should have been made available for use by UMTS/IMT-2000 systems by 1 January 2008, subject to market demand and national licensing schemes.

- ECC/DEC/(05)05 (March 2005) which designates the 2.6 GHz band for terrestrial IMT-2000/UMTS and contains a channel plan for the harmonised utilisation of spectrum in the 2.6 GHz band for terrestrial IMT-2000/UMTS.

2.60 The UK has not implemented the ECC Decisions described in paragraph 2.59.

France

2.61 The UK has entered into a MoU with France for the 2.6 GHz band. This is included at Annex 8 to this Memorandum. We have received proposals from France to consolidate the existing MoUs in a single document and modify the coordination thresholds for the 2.6 GHz band.

Ireland

2.62 The UK has entered into a MoU with the Republic of Ireland for the 2.6 GHz band. This is included at Annex 9 to this Memorandum.

International allocations and uses adjacent to the 2.6 GHz band

2.63 The international allocations that apply to the 2450 to 2500 MHz band and the 2690 to 2900 MHz band in neighbouring countries are currently identical to those indicated in the UKFAT, except that there is no exclusion of aeronautical mobile use in the international table in 2483.5 to 2500 MHz. As noted in paragraph 2.27, WRC-12 added a primary allocation to the radiodetermination-satellite service (space to Earth) in the 2483.5 to 2500 MHz band. This allocation will become effective when the new version of the Radio Regulations enters into force, on 1 January 2013. Further information is available in the Radio Regulations and from CEPT[21].

Other emissions in the 2.6 GHz band

Ultra Wideband (UWB)

2.64 UWB technologies were harmonised in the European Community in 2007 (Decision 2007/131/EC[22]). This harmonisation measure was subsequently amended by Commission Decision 2009/343/EC[23]. These harmonisation measures were

[19] http://www.erodocdb.dk/Docs/doc98/official/pdf/REC0101e.PDF
[20] http://www.erodocdb.dk/docs/doc98/official/pdf/Dec0206.pdf
[21] See for example http://www.efis.dk
[22] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:055:0033:0036:EN:PDF
[23] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:105:0009:0013:EN:PDF

implemented by Statutory Instrument (SI) 2009/2517[24], which came into force on 15 October 2009. The European Commission Decision harmonises the use of Generic UWB apparatus across the 800 MHz band, whereas both Generic UWB apparatus and Specific Building Material Analysis UWB apparatus are harmonised across the 2.6 GHz band. The generic UWB limits are set out in SI 2009/2517.

[24] http://www.legislation.gov.uk/uksi/2009/2517/made/data.pdf

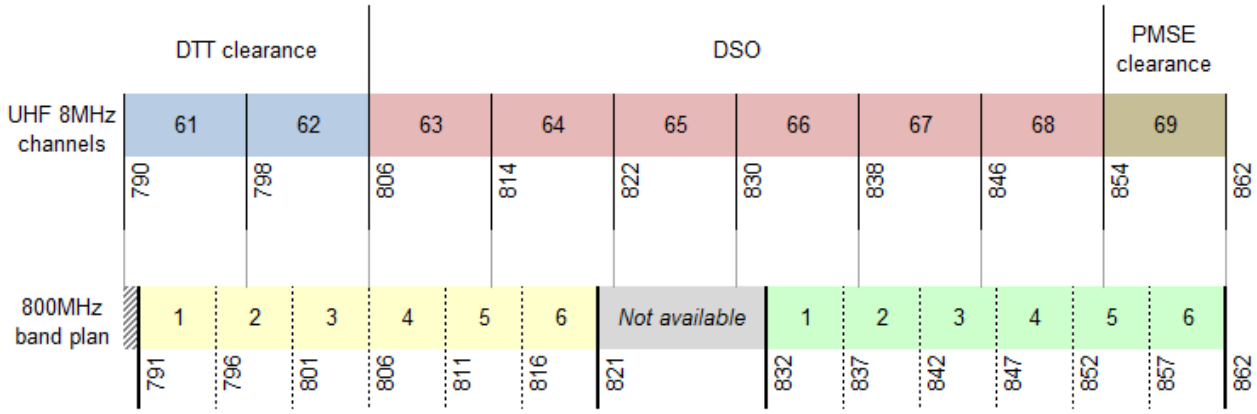
Section 3

Factors affecting use of the spectrum bands

Other uses in the 800 MHz and adjacent bands

3.1 The availability of the 800 MHz band for electronic communications services depends on the re-location of DTT services and PMSE users to other bands. Figure 3.1 shows how UHF channels used for DTT and PMSE align with the blocks for mobile use in the 800 MHz band.

Figure 3.1: UHF channels and 800 MHz band plan



DTT clearance

3.2 In our statement of June 2009 on clearing the 800 MHz band we set out our decision to allow use of the whole band for mobile services by clearing channels 61 and 62 (790 to 806 MHz) of DTT[25]. Until the DTT users of these channels have been re-located to alternative spectrum the 800 MHz band will not be fully available for use by mobile services.

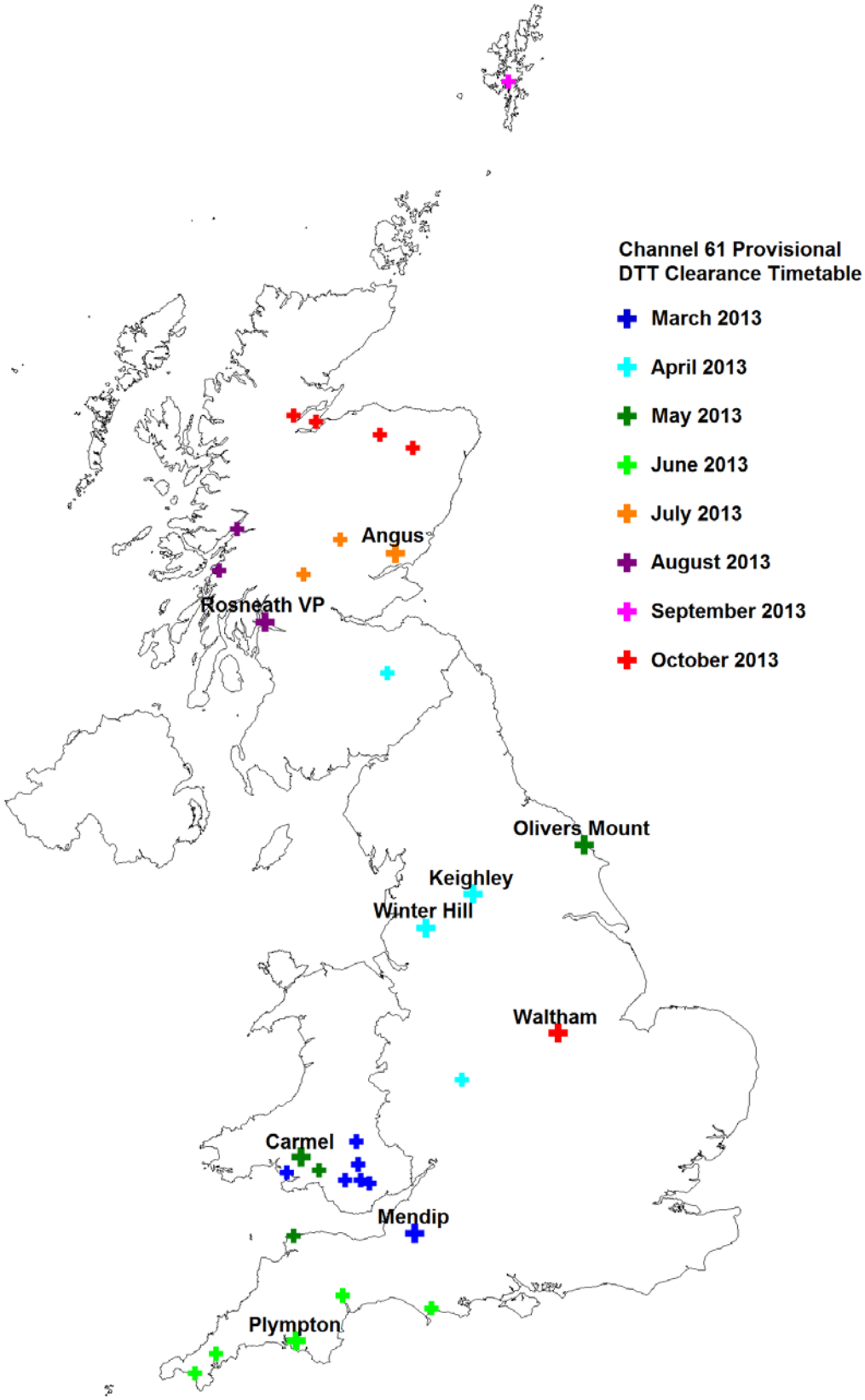
3.3 DTT clearance will progress geographically, so that some parts of the UK will become available for new 800 MHz services earlier than others. Our current expectation is that Northern Ireland will be cleared by the end of calendar year 2012; Wales by the end of May 2013; England and Scotland by the end of October 2013.

3.4 The 2013 timetable for clearing DTT from channel 61 and 62 is set out in Ofcom's "Notice of transitional restrictions on Mobile Networks in the 800 MHz band for protection of DTT in channels 61 and 62" (the DTT Transitional Notice), a copy of which is at Annex 6 to this Memorandum. DTT clearance will take place on a transmitter by transmitter basis. Figures 3.2 and 3.3 illustrate where and when DTT stations will clear channels 61 and 62 respectively during 2013.

[25] http://stakeholders.ofcom.org.uk/binaries/consultations/800mhz/statement/clearing.pdf

3.5 The DTT licensees have informed Ofcom that they have instructed their supplier, Arqiva, to plan network changes according to the timetable provided in the draft DTT Transitional Notice, which has been developed with Arqiva. They informed Ofcom that they intend to put on a contract basis 2013 clearance dates four months in advance of each change, at which time they will make public each date. The timetable forecasts clearance of all DTT stations from channels 61 and 62 by the end of October 2013. Ofcom will issue updates to the DTT Transitional Notice with the exact dates of clearance when these are published.

3.6 Note that many other DTT stations which also change channels as part of the 2013 DTT clearance programme are not included in the DTT Transitional Notice or Figures 3.2 and 3.3, as they do not directly involve channels 61 or 62 (they are consequential changes). Also not included are DTT stations clearing in Q4 2012 (including some on channels 61 and 62), as this predates the planned award of licences for new 800 MHz services.



3.7

Figure 3.2: DTT Channel 61 Clearance in 2013
(Main stations are the labelled larger crosses)

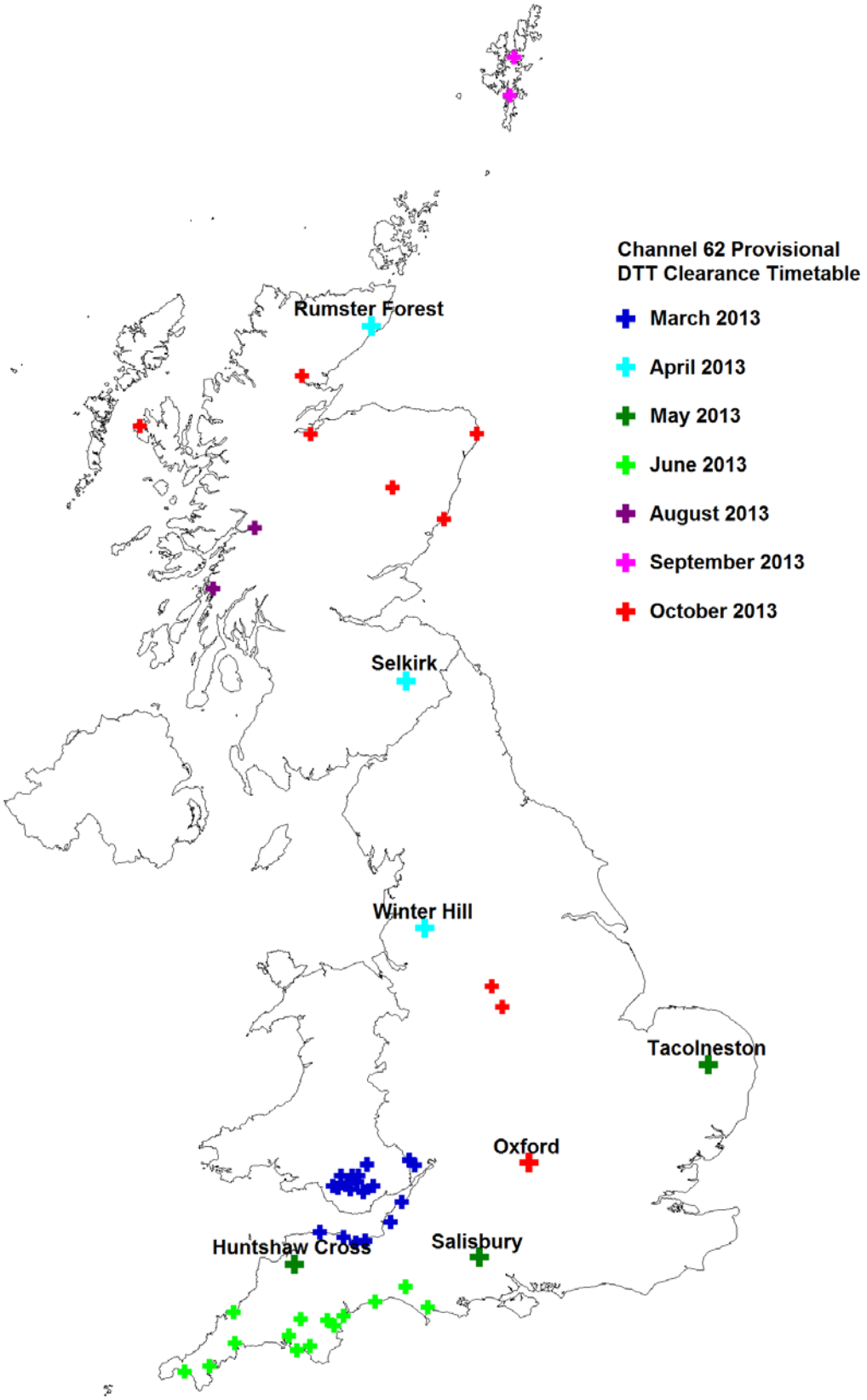


Figure 3.3: DTT Channel 62 Clearance in 2013
(Main stations are the labelled larger crosses)

DTT Protection Requirements

3.8 While a DTT station continues to broadcast on either channel 61 or 62, its DTT services will need to be protected on an ongoing basis from potential interference from mobile services in the 800 MHz band. The protection requirements will be set out in the DTT Transitional Notice, which the 800 MHz licensees will be required to comply with under the terms of their licences.

DTT Licensing

3.9 Ofcom will also vary the DTT multiplex licences[26] accordingly in advance of DTT clearance.

3.10 Currently the DTT licences only include "backstop" dates, which were inserted earlier in the programme. These are 31 December 2013 for England and Wales, and 30 September 2014 for Scotland. Ofcom may amend these backstop dates after consulting with DTT licensees. There is no formal "backstop" date for Northern Ireland at this stage because the intention remains that DTT clearance will be completed at digital switchover in October 2012.

Interference from DTT to 800 MHz mobile services

3.11 DTT stations still operating in the 800 MHz band in 2013 may cause interference to mobile services in the band. As illustrative examples of the potential for DTT interference to mobile services, Ofcom commissioned Arqiva to provide field strength predictions for Tacolneston, Oxford and Waltham DTT stations, using the UK planning model. These illustrative predictions were presented to 800 MHz award stakeholders, in November 2011, at an Ofcom workshop[27] on the DTT clearance timetable. Since plans for where and when mobile services will start rolling out are currently undetermined, the DTT Transitional Notice includes the DTT station parameters necessary for recipients of this Memorandum to make their own assessment of the likelihood of DTT interference to their particular deployment plans.

PMSE use in 800 MHz

3.12 Our decision to clear the 800 MHz band and release it for mobile services means that PMSE use in channels 61-69 must cease throughout the UK by 31 December 2012. PMSE use of channels 61 to 69 after that date will be unlawful and liable to enforcement action by us.

Uses in bands adjacent to 800 MHz

DTT below 790 MHz

3.13 The current generation of TVs, set top boxes and equipment used to receive DTT was designed to receive signals across the whole TV band, including the 800 MHz spectrum. This means that when mobile services begin transmitting in the 800 MHz band, there will be the potential for interference from mobile base stations. This could affect the ability of some people to receive DTT.

3.14 Our technical analysis shows that without action to mitigate the interference, up to 2.3m households may lose the ability to access DTT services, either partially or

[26] http://licensing.ofcom.org.uk/tv-broadcast-licences/current-licensees/multiplex/
[27] http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/annexes/workshop.pdf

completely. Approximately 40% of households in the UK use DTT as their only means of accessing TV, so around 900,000 DTT-only households could be affected. This would mean those households losing some or all of their TV channels.

3.15 In February 2012 the Government took decisions on the level of support that would be provided to consumers of DTT services to mitigate the interference issue. These decisions were summarised in our second consultation published on 23 February 2012.[28] On 10 July 2012, the Government published a letter confirming these decisions and providing clarification on a few areas of detail. This letter is published on the DCMS website[29]. The Government decisions include the following:

- Funding totalling £180m should be provided by Licensees in the 800 MHz band (800 MHz Licensees) to fund the provision of consumer support in relation to mitigating interference into DTT from the use of new services in the 800 MHz band;
- Any underspend of the £180m funding should be returned in full to the 800 MHz Licensees;[30]
- Consumer support should be offered to mitigate interference into primary sets (but not additional sets) as follows:
    - Consumers affected by interference should receive information, filters on a proactive and reactive basis and, where filters fail to resolve the problem, a platform change;
    - Vulnerable consumers affected by interference should receive extra support, including installation of filters where needed. Vulnerable is defined using the same criteria as those under the Digital Switchover Help Scheme (see footnote 52 below); and
    - Installation support in the form of vouchers (to a value of £50 + VAT) should be provided to households affected by interference whose DTT TV installation includes a mast-head amplifier;
- MitCo should remain in existence until one year after the date for meeting the coverage obligation, or network roll out completes, whichever is earlier.[31]

3.16 The 800 MHz Licensees will be required by their Licences to comply with procedures notified to them by Ofcom. Ofcom will notify the 800 MHz Licensees of the procedures annexed to this Memorandum at Annex 5 (the DTT Interference Mitigation Procedures). The DTT Interference Mitigation Procedures require the 800 MHz Licensees to provide consumer support in line with the Government's decisions. Section 5 of this Memorandum describes the licence conditions relating to DTT coexistence.

[28] http://stakeholders.ofcom.org.uk/consultations/second-coexistence-consultation/
[29] http://www.culture.gov.uk/images/publications/letter-dcms-ofcom-10072012.pdf.
[30] This updates and replaces the February 2012 decision in which underspend was to be shared equally between licensees and the Government.
[31] This updates and replaces the February 2012 decision in which the backstop date for closure was 2017

Emergency services in 862 to 863 MHz

3.17 The 862 to 863 MHz band is available for emergency services and supports a number of communication systems that are used throughout the UK by the Home Office (HO) and Fire and Rescue Services (FRS).

3.18 Work commissioned by Ofcom and other stakeholders, including research reports and technical studies[32], suggests that without plans to manage interference risks there could be interference between the emergency services systems operating in adjacent frequencies and mobile services in the 800 MHz band. Information on Government and stakeholder plans to manage these interference risks and discussion of any remaining risks, where identified, is set out below.

Home Office system

3.19 The technical studies indicate that there is potential for two-way interference between the Home Office System (HOS) and mobile services in the 800 MHz band.

3.20 HO has agreed a plan with the Department for Culture, Media and Sport (DCMS) for mitigating the risk of interference between the HOS and mobile services in the 800 MHz band. The plan is to modify elements of existing telemetry equipment to operate in the 870 to 872 MHz band. The modified HOS features a number of fixed base stations and mobile units transmitting at a low duty cycle in the 870 to 872 MHz band. HOS signals from fixed or mobile transmitters are omnidirectional burst signals of 5 seconds or 1 minute duration. Transmit power is up to +44dBm EIRP. This is a 25 kHz FM signal, which tests show to have the same effect on an LTE base station receiver as an unmodulated carrier wave signal of the same power. There are around 100 HOS fixed transmitters in the UK, sited to give coverage of urban areas and trunk routes. Each has a duty cycle of 0.1% to 3%, biased towards daytime and highest in cities such as London.

3.21 The timetable for implementing the modification plan has been agreed and HO has appointed a contractor to complete the work. At present, the plans indicate that the modification will be complete by the end of Q1 2013. We intend to provide an update on this before the start of the Award Process. HOS use of 870 to 872 MHz will not require any restrictions on use of the 800 MHz band for mobile services in the short or long term. Therefore, no special licence conditions will be placed on the new 800 MHz licensees in relation to this issue. In the longer term the HO is planning to roll out a replacement system to address the increasing risk of interference into the modified HOS as 4G networks expand and 4G handset deployment grows.

3.22 Mobile services in the 800 MHz band may be affected by interference from the following:

- the modified HOS operating in the 870 to 872 MHz band (until such time as it is replaced); and
- some occasional legacy use of the existing HOS at 862 to 863 MHz.

[32] These include the following reports that are publicly available:- Thales http://stakeholders.ofcom.org.uk/consultations/technical-licence-conditions/thales-report for FRS plus reports from Aegis Systems Engineering (and ERA Technology) http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-awards/spectrum-clearance/Aegis_Report.pdf and Risktec Solutions Ltd http://www.cfoa.org.uk/13371

An indicative assessment of these risks is set out below.

3.23 Following the award, the new 800 MHz licensees will be able to seek bilateral coordination briefings with HO in order to help plan their 4G networks to reduce the risk of interference from the HOS or modified HOS. HO has agreed to provide briefings to representatives of licensees that have appropriate security clearance to view information about HOS.

3.24 In the meantime, the following information on the modified HOS and legacy use of the existing HOS provided by HO may be useful to potential bidders in making their own assessment of the risk of interference to mobile services in the 800 MHz band. This information is based on the following HO assessments: theoretical analysis using the ETSI standards for LTE and confidential information provided by mobile network operators (MNOs) about equipment performance; some limited practical testing using an example LTE base station; and an assessment of the probability of interference into LTE in the 800 MHz band from HO mobile units.

3.25 The theoretical analysis of free space separation distances suggests that there is a risk that LTE base station receivers will experience an increase in noise greater than 1dB when within 440m of a HOS fixed site location. Limited practical testing by HO indicated a 10% reduction (for a high bit rate service) in uplink user throughputs at 750m line-of-sight from a HOS base station (for a far user on an LTE wide area base station receiving on Block C (811-821 MHz and 852-862 MHz), the 10 MHz block at the top of the 800 MHz band.) At 100m separation distances the practical tests showed a single user data throughput of 2 Megabits per second (2Mbps). During the practical tests, systems operating in blocks A (791-801 MHz and 832-842 MHz)and B (801-811 MHz and 842-852 MHz) were seen to be a little less susceptible to interference reducing the distances from 750m to 500m for a 10% reduction in achievable uplink throughput. LTE users that were not as close to the cell edge also showed considerably less susceptibility, reducing the separation distance to around 120m for a 10% reduction in achievable uplink throughput.

3.26 The practical tests also indicated that interference from the HO fixed base stations causes a graceful decrease in data throughput without loss of connection. On the basis of these results, we would expect that new licensees in the 800 MHz band may be able to mitigate further the risk of interference from fixed base stations by fitting filters on affected base stations or coordinating their site locations with those of the HOS.

3.27 In order to assess the number of LTE sites that might be affected, further analysis based on the site portfolios of several MNOs is presented in the table below. The range indicates the number of macro and micro site locations that might fall within the radii of a HOS fixed site. Analysis is based on some of the MNOs' current site portfolios and HOS base stations in Great Britain (excluding Northern Ireland) from 2009, although the latter has not materially changed since that data set was created. For the number of sites affected, it is expected that the end of the lower range is representative of an approximately 12,000 site network and the upper end of the range is more representative of a greater than 20,000 site network.

Table 3.1: Number of sites within radii of HOS fixed sites

Separation Distance (m)	Number of sites affected
100	18 to 29
200	31 to 53
300	41 to 81
400	50 to 107
440	51 to 119
500	56 to 136
600	67 to 175
750	87 to 218
800	93 to 239
1000	128 to 326
1200	167 to 451
1400	217 to 617
1600	277 to 770
2000	382 to 1111
2200	441 to 1307
3000	782 to 2238

3.28 There are an additional number of mobile units with similar radio parameters. HO has determined an overall usage estimate for mobile units based on the overall number of units and frequency of use. These mobile units may be located anywhere in the country, although usage is typically focused around urban areas and trunk routes. Assuming a typical LTE network operating in Block C with cell edge users, the average probability that a given LTE base station will be affected by greater than 1 dB is approximately 1 in 4.8 million, which equates to 6.5 seconds per year. The above likelihood of interference is reduced when a cell has users that are not operating at the limit of coverage of a base station. Where these users have a path loss that is 20dB lower than that at the cell edge, then the above probability is reduced by a factor of approximately 20.

3.29 Some occasional use of legacy equipment at 862 to 863 MHz will continue after Q1 2013. Theoretical analysis of free space separation distances suggests that there is a risk that LTE base station receivers will experience an increase in noise greater than 1dB when within 1400m of a HOS fixed site location. Limited practical testing by HO indicated a 10% reduction (for a high bit rate service) in uplink user throughputs at 2000m line-of-sight from a HOS base station (for an LTE wide area base station receiving on Block C). Results for Block C users that are not as close to the cell edge suggest a separation distance of around 525m might be appropriate for a 10% reduction in achievable uplink throughput. Results are similar for systems operating in Blocks A and B. Occasional legacy use at 862 to 863 MHz is estimated by the HO to comprise 1% of all transmissions until December 2013 and 0.1% thereafter. Factoring in the reduced number of transmission but increased separation distances (up to 1400m), the average probability of interference from all HOS use caused to an LTE base station supporting cell-edge users is estimated to increase by 3%.

Fire and Rescue Services

3.30 Some FRS use radio equipment (telemetry) integrated with their breathing apparatus equipment (BA Telemetry) which uses spectrum that is adjacent to the 800 MHz band. BA Telemetry collects real-time data during incidents, allowing the continued monitoring of the air supply of each individual firefighter's breathing apparatus and other data to assist the operational response to incidents.

3.31 Work commissioned by Ofcom and other stakeholders (see paragraph 3.18 above) suggests that FRS BA Telemetry could be affected by interference from LTE services. As a result, the Chief Fire Officers Association (CFOA) led a working group including representatives from FRS and Department for Communities and Local Government (DCLG) to consider solutions, with support from Ofcom (the "Working Group"). The Working Group made recommendations on short and longer term measures to ensure BA Telemetry can continue to be used safely. These have been endorsed by the CFOA's National Operations Committee, the relevant CFOA Board Director, and DCLG and have been approved by DCMS's Spectrum Clearance and Award Programme (SCAP) Board.

3.32 This solution involves moving FRS BA Telemetry users to 869.5 MHz (a frequency that is licence-exempt) in the short term (current plans anticipate this to be complete by calendar Q1 2013) before moving in the longer term to a new dedicated frequency.

3.33 The SCAP Board is facilitating the development of the solution by making funding available for both the short- and long-term measures that have been identified, including delivery and assurance.

3.34 Responsibility for deciding whether to adopt the solution recommended by the Working Group rests with individual fire and rescue authorities. DCLG issued a letter dated 2 July 2012 notifying Chief Fire Officers (CFOs) that the Working Group's recommendations had been endorsed. It invited CFOs to let CFOA and Government know if their authority intends to adopt the recommended solution and provided them with an opportunity to give their views on the delivery route that should be followed.

3.35 BA Telemetry users are anticipated to move from 862.9625 MHz in the first quarter of 2013 and so will no longer be in the 862 to 863 MHz band. BA Telemetry will then be in the SRD band and will be compliant with the standards of that band. In any case, we consider there is limited risk of interference into mobile broadband from the system in its current allocation. BA telemetry has a maximum 10% duty cycle and is used at incidents by some fire and rescue services. The risk of interference into LTE from equipment operating at 862.9625 MHz is therefore limited to the geographical areas around an incident involving breathing apparatus.

3.36 In light of the above, we are not including a condition in relation to this issue restricting LTE use in the 800 MHz licences.

Short-range devices in 863 to 870 MHz

3.37 Short Range Devices (SRDs) operate in the 863 to 870 MHz band on a harmonised basis across Europe.

3.38 No licence is required to operate SRDs in the 863 to 870 MHz band and devices are deployed on a non-interference/non-protected basis, as defined by the European

Commission[33]. Nevertheless, in line with a general duty to consider the impact of its decisions on other spectrum users, Ofcom has considered the likely interference risk in relation to SRDs.

3.39 The deployment of mobile services in the 800 MHz band introduces a potential risk that these SRD applications may experience interference from user equipment (UE) operating in the band. The circumstances in which interference might occur are limited, but could include, for example, the user of a LTE handset or dongle sending a large amount of data to another user while in close proximity to an SRD device.

3.40 On 2 June 2011, we published proposals for the technical licence conditions we intend to apply to the 800 MHz (and 2.6 GHz) band (the June 2011 Consultation)[34]. That document considered how interference from mobile services operating in those bands might affect a wide range of products and service, not limited to SRDs. We said we did not anticipate it would be necessary to impose technical licence conditions to protect SRDs from interference from mobile services operating in 832 to 862 MHz.

3.41 We subsequently carried out a range of technical tests to see how LTE UE might affect the operation of SRDs, and published the results[35].

3.42 On 30 November 2011 we set out in an Information Update (the November Information Update)[36] that, having reviewed stakeholders' responses to our proposals and having considered the further research which we had undertaken at that time, we remained of the view (as set out in the June 2011 Consultation) that it would not be appropriate to apply technical licence conditions to the 800 MHz licences to protect SRDs. Since that time we have conducted further research[37]. In addition, we have enabled manufacturers to test, at our Baldock Technical Measurements Centre[38], a wide range of SRDs in the presence of recordings of LTE signals, to enable them to check compatibility of their devices.

3.43 Much of the research was conducted on the basis of "worst case" scenarios, such as LTE users uploading very large amounts of data at very high power close to the SRD being tested. To gain a better understanding of the OOB emissions on the SRD band in more likely usage where the worst case scenarios are not continuously experienced, Ofcom has undertaken further testing between November 2011 and April 2012 with some example production LTE UE devices. This testing remains consistent with our judgement set out in the November Information Update that the proposal not to apply technical licence conditions to the 800 MHz licences to protect SRDs is appropriate. We intend in due course to publish a report of this testing.

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[33] Commission Decision of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices (2006/771/EC) as amended (Article 3(1)).

[34] Consultation and information on technical licence conditions for 800 MHz and 2.6 GHz spectrum and related matters published by Ofcom on 2 June 2011

[35] ERA Technology *Investigation on the receiver characteristics of SRD equipment in the 863 to 870 MHz band*. http://stakeholders.ofcom.org.uk/binaries/consultations/tlc/annexes/SRD-Study.pdf

[36] *Use of Short Range Devices alongside mobile broadband services operating in the 800 MHz band* http://stakeholders.ofcom.org.uk/binaries/consultations/tlc/annexes/Update.pdf

[37] ERA Technology *Investigation of LTE UE interference into Social Alarms* http://stakeholders.ofcom.org.uk/binaries/consultations/tlc/annexes/LTE_UE.pdf and *Potential for LTE interference to Wireless Audio* http://stakeholders.ofcom.org.uk/binaries/consultations/tlc/annexes/Wireless_Audio_Testing.pdf

[38] http://stakeholders.ofcom.org.uk/binaries/consultations/tlc/annexes/test-facility.pdf

3.44 We are continuing to contribute to the work of European standards agencies, predominantly within ETSI and the Spectrum Engineering (SE) division of the European Conference of Postal and Telecommunications Administrations (CEPT). CEPT SE24[39] and ETSI ERM TG28[40] are both considering the standards which currently apply to SRDs and their consistency with LTE standards.

3.45 There is also a formal process provided within the R&TTE Directive for administrations or the Commission to address shortcomings in harmonised standards. This procedure is detailed in Article 5.2 of the Directive and is known as a "safeguard" procedure. Where proportionate and demonstrated by evidence of harmful interference, this procedure could be used to amend equipment standards, if the outcome of the CEPT and ETSI studies was to recommend this.

3.46 As set out in Annex 11 to the Statement, our conclusion remains that the imposition of licence conditions is not appropriate. If a user or manufacturer of an SRD is concerned about the potential for a small increase in the overall probability that an SRD might suffer interference it may have a number of options. These may include migration to other frequency bands, changes to the characteristics of SRD signal transmission (such as ensuring alarms send repeated signals until the call is acknowledged), alternative technologies, or provision of advice or information to consumers.

Factors affecting the availability of the 2.6 GHz band

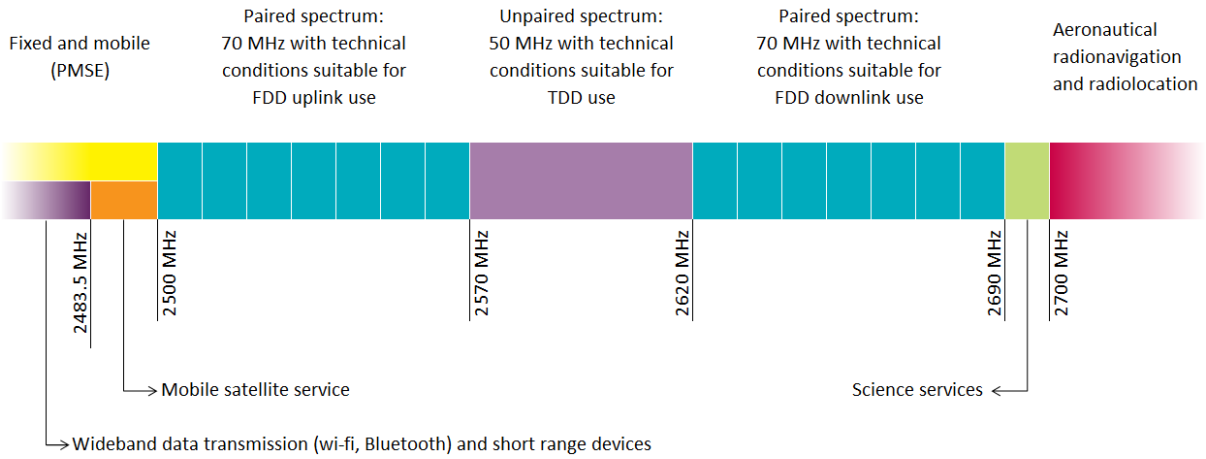
Radars in the S-band

3.47 As set out at paragraph 2.37, aeronautical radionavigation and radiolocation services operate in the S-band, adjacent to the 2.6 GHz band. Frequency allocations in the lower part of this band are jointly managed by the CAA and the MOD. The lower part of this band, 2700 to 2900 MHz is mainly used for primary surveillance radar, used for civil and military ATC, as well as some other military and civil radars. The upper part of the band, 2900 to 3100 MHz is also used for maritime radar. Frequency allocations in the upper part of this band are jointly managed by the CAA, the MOD and the Maritime Coastguard Agency (MCA).

[39] SE24 undertakes compatibility studies in support of CEPT Working Group SE (Spectrum Engineering) activities on short-range devices (SRDs). See http://www.cept.org/ecc/groups/ecc/wg-se/se-24/page/terms-of-reference

[40] The European Telecommunications Standards Institute (ETSI) produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies. ERM is one of its technical committees covering EMC (electromagnetic compatibility) and spectrum matters. Technical Group 28 deals with SRDs. See http://portal.etsi.org/erm/ERMtg28_ToR.asp

Figure 3.4: The 2.6 GHz band and adjacent bands



Risk of interference to radars from the 2.6 GHz band

3.48 Radars are designed to detect very low power signals in their own frequency bands, and receivers can be filtered to ensure that transmissions from adjacent frequency bands are not also detected. However, where filtering is insufficient, higher power transmissions from adjacent bands, even those which are well separated in frequency terms, can still be detected by radars and their performance can be degraded as a result.

3.49 Some radars in the S-band have poor receiver selectivity and are vulnerable to interference from use of the 2.6 GHz band for mobile services compared to typical modern receivers. The radars we are concerned with are used for ATC and some defence purposes, and interference which reduces their ability to operate effectively could have unacceptable implications from a safety of life and national security perspective. Our tests have shown that, for example, when subject to emissions within the 2.6 GHz band, an ATC radar's ability to detect targets (e.g. aeroplanes) was reduced.

3.50 We published an Information Update on the coexistence of S-band radar systems and adjacent future services on 11 December 2009[41] which set out the potential scope of the issue and the work we were undertaking.

Civil and military air traffic control radar

3.51 Since then Ofcom has commissioned further work from manufacturers of ATC radars to establish the feasibility of designing a modification which would reduce the susceptibility of these radars to interference.

3.52 This work has been in two stages. Ofcom first commissioned feasibility studies, with the aim of establishing whether a modification would be feasible in theory. The feasibility studies concluded that there were viable routes to designing a modification to the radar which made it more resilient to interference with minimal impact on radar performance.

[41] http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-awards/awards-in-preparation/infoupdate.pdf

3.53 Ofcom then contracted with each of the five design authorities for prototype solution designs for each of the radar types in the UK ATC radar fleet, to establish whether a modification could be developed in practice which reduced the vulnerability of the radar. Radar manufacturers have been contracted to develop prototype modifications which take into account actual UK radar fleet variations, and achieve a very low loss in radar performance.

3.54 We signed off the first prototype modification in June 2012 and we expect the last prototype modification to be delivered by the end of September 2012. All of the manufacturers we have contracted with have confirmed that they are confident that the prototype modification will meet the requirements of the contract.

3.55 We have also carried out some technical trials, using a simulated LTE base station, to test the impact on ATC radar. The test supported the findings of the previous studies and confirmed that, unless action is taken to modify the radars to improve selectivity, use of the 2.6 GHz band for mobile services does cause a significant degradation of the radar's ability to operate effectively.

Other radars in the S-band

3.56 There are a number of other radars in the S-band, including ship borne maritime radars, port radars, and a small number of weather radars and bird detection radars. We have considered whether any regulatory action is required in relation to these other radars.

3.57 In August 2011 we published a technical assessment relating to communications signals in the 2.6 GHz band and maritime radar[42]. Based on that assessment, and on the previous work carried out by the MCA, alongside our engagement with the maritime stakeholders, we concluded that there was no justification for imposing additional constraints on use of the 2.6 GHz band in order to protect ship borne maritime radar. In June 2012, we assisted the MCA with the testing of maritime radars, using simulated 4G signals. The tests appeared to show no discernible loss in performance in either magnetron or solid state radar at 2.6 GHz communications signal levels of at least those levels used for 'onset of degradation' ranges calculated in our August 2011 technical report.

3.58 As noted in our 2009 Information Update, a number of ports operate land-based S-band maritime radars. We have liaised with the relevant port authorities about their radars' location and operational requirements. Based on this stakeholder engagement, we concluded that there was no justification for imposing additional constraints on the use of the 2.6 GHz band in order to protect the radars in question.

3.59 There are other radars in the S-band, including bird detection radars and meteorological radars. We have not identified any reason to restrict use of the 2.6 GHz band in order to protect these radars.

Radar remediation programme

3.60 In November 2010 Government requested an implementation plan from Ofcom, MOD and CAA for remediating radars to enable the spectrum release. This was submitted in February 2011, following which a cross-Government programme was established.

[42] http://stakeholders.ofcom.org.uk/spectrum/spectrum-awards/awards-in-preparation/award_2010/comm-signals-26-band/

The radar remediation programme comprises DCMS, MOD and the Department for Transport (DfT), supported by the CAA and Ofcom as set out in Table 3.2 below.

Table 3.2: Organisation roles in HMG radar remediation programme

Organisation	Role in HMG radar remediation programme
DCMS	• Governance for HMG radar remediation programme
DfT	• Coordinating roll-out plan for modifications to civil radars • Administering grant scheme to support industry implementation of modifications to civil radars
MOD	• Implementation of modifications to military radars
Ofcom	• Award Process • Coordination procedures for deployment of services in the 2.6 GHz band to protect radars • Development of prototype solution design
CAA	• Licensing and frequency management for radars • Regulatory oversight of the safety of UK radar services through regional offices • Facilitation and expert advice on technical and operational issues related to the operation of civil radars.

Radar modification programme

3.61 The DfT has put in place a team to coordinate the roll-out plan for modifications to civil radars and administer the grant scheme that the Government has put in place to support operators when implementing modifications to civil radars.

3.62 Civil radar operators are licensed under the WT Act. Ofcom intends to issue a notice to all such licensees requiring them to take steps to ensure that their radars can coexist with transmissions in the 2.6 GHz band, by a backstop date. The backstop date Ofcom has proposed is the end of the first half of 2015, three years after the date when we expect the last prototype modification to be available.

3.63 The purpose of the DfT's coordinated roll-out plan and grant scheme is to ensure the modifications to civil radars happen earlier than the Ofcom backstop date, so that radars in most of the UK are modified by the end of 2013, thereby allowing widespread deployment of mobile services in the 2.6 GHz band.

3.64 The MOD has a coordinated programme in place to implement modifications, where they are needed, to MOD radars, on a timetable aligned with the civil programme.

3.65 The regional timetable for modifications of civil and military radars is set out in the table below. Modifications to individual radars will be taking place from autumn 2012. The first large tranche of modifications is due to be completed by the end of Q3 2013, with modifications across all of the UK completed by the end of Q1 2014.

Table 3.4: Radar modification roll-out dates by region

	Complete by end Q3 2013				Complete by end Q4 2013		Complete by end Q1 2014		
	London & South East	**Midlands**	**North West**	**Yorkshire**	**Central Scotland**	**Tyneside**	**South West & Wales**	**Northern Ireland**	**Highlands / rest of Scotland**
Civil radars	Birmingham Cambridge Cromer Farnborough Gatwick Heathrow Southampton Manston Norwich Oxford Southend Stansted	Bristol Coventry East Midlands	Blackpool Hawarden Liverpool Manchester St Annes	Durham Tees Valley Hibaldstow Humberside Leeds / Bradford Robin Hood (Doncaster)	Cumbernauld Edinburgh Glasgow Kincardine Prestwick	Newcastle	Bournemouth* Cardiff Exeter* Newquay*	Belfast City Belfast (Int'l)	Allanshill Inverness Sumburgh
Military radars	Brize Norton Coningsby Cranwell Honington Lakenheath Marham Middle Wallop Odiham Waddington	Benson Cosford Cosford (TAC) Cosford (T101) Scampton Shawbury	Brizlee Wood	Leeming Test Rig Leeming Linton-on-Ouse Staxton Wold Topcliffe	Leuchars**	Spadeadam BH** Spadeadam DWF**	Aberporth** Boscombe Down** Culdrose Hartland Point Manorbier Portland** Portreath Yeovilton Valley Wembury Point		Lossiemouth* St Kilda A* St Kilda S* West Freugh

* Will be modified by end Q4 2013. ** Will be modified by end Q3 2013.

Coordination procedures and protection thresholds

3.66 The HMG radar remediation programme is intended to ensure that, where necessary, radars in the S- band are modified to become more resilient to interference from the adjacent band. However, even after this programme is completed we expect radars to have some residual sensitivity to emissions from the 2.6 GHz band.

3.67 Coordination procedures are needed to ensure that when networks are deployed in the 2.6 GHz band, they do not cause harmful interference to civil and military radars in the adjacent S- band. The coordination procedures set out the protection thresholds with which 2.6 GHz licensees will need to comply. Different thresholds will apply before and after radars are modified. The thresholds will be less restrictive once the modification has been completed at each radar site.

3.68 The draft coordination procedures are at Annex 3 of this Memorandum.

3.69 The coordination procedures apply to all radars on the protected radar list. This includes the current fleet of civil and military ATC radars, and a small number of air defence radars, operating in the 2.7 GHz band in the UK. A high level protected radar list, showing location of radars by airfield and postcode, is annexed to the coordination procedures.

3.70 To comply with the coordination procedures, 2.6 GHz licensees will need to know the location of the radar and the antenna height. This further information will be made available to the 2.6 GHz licensees after the Award Process as part of a detailed protected radar list. The area where the radar is protected is limited by the airfield boundary. 2.6 GHz licensees must ensure that their deployment is able to comply with the threshold in relation to all of that area.

3.71 A 2.6 GHz licensee will need to check the protected radar list when it plans and deploys its base stations. The protected radars list will be periodically updated and reissued by Ofcom. 2.6 GHz licensees must ensure they consult the most recent version of the protected radar list.

3.72 The onus will be on the 2.6 GHz licensee to check whether they meet the threshold specified in the coordination procedures. To do so, the 2.6 GHz licensee will have to calculate the power of the communications signal and the OOB noise at the radar. The parameters for this calculation are set out in the coordination procedures. If the planned deployment is shown to not exceed the threshold deployment can go ahead. If the calculation shows that it would exceed the threshold, the 2.6 GHz licensee can consider adjusting the deployment. If that means that the threshold is complied with no other action is required. If it is not possible to adjust the base station so that the threshold is met, deployment can only go ahead if agreement is reached with the operator of that radar.

3.73 When a new radar is deployed, it will need to take account of existing deployment in the 2.6 GHz band. 2.6 GHz licensees will not be required to adjust the technical parameters of base stations that have already been deployed to take account of new radar deployment. However, where a radar operator does wish to deploy a new radar and there is a 2.6 GHz licensee with an existing base station that may interfere with that new radar, it would be open to the parties to seek to resolve between themselves any coordination issues that would arise as a result of the intended radar deployment.

Impact on spectrum availability in the 2.6 GHz band

3.74 We have conducted some indicative analysis to assess the impact of the radar protection thresholds in the coordination procedures on the ability to deploy in the 2.6 GHz band. We have looked both at the thresholds for in-band signals and for OOB noise.

3.75 In this section we provide a number of maps to illustrate the potential impact of the radar protection thresholds on the ability to deploy services in the 2.6 GHz band. It should be noted that these are for illustrative purposes only, and are specific to the assumptions used in each case.

3.76 The maps on the following pages illustrate some of the modelling we have carried out, showing the areas where a 2.6 GHz licensee may exceed the radar protection threshold:

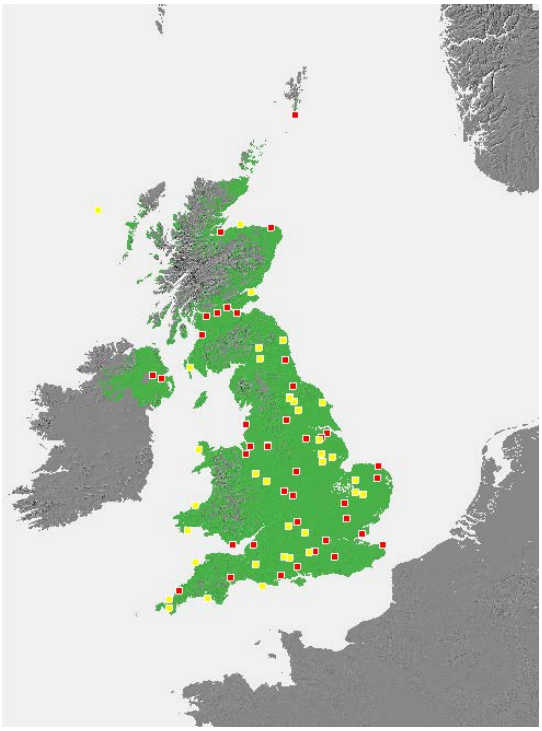
- for the threshold for in-communications-band signals, at different stages in the radar remediation programme, assuming that the 2.6 GHz deployment operates at maximum permitted power and the band is fully utilised. As more radars are modified, the areas where the protection threshold may be exceeded are reduced;
- for the threshold for in-communications-band signals, comparing a range of assumed, decreasing base station powers at the end of Q3 2013. A lower power at the base station reduces the area where the protection threshold may be exceeded; and
- for the threshold for OOB noise, assuming that the 2.6 GHz deployment operates at maximum permitted power and the band is fully utilised, and assuming a lower base station power. A lower power at the base station reduces the area where the protection threshold may be exceeded.

Threshold for in-communications-band signals – changes over time

3.77 The following maps have been produced using ICS Telecom with ITU-R P.452 propagation model, with a 0.1% time percentage and including both terrain and clutter. It has been assumed that base stations operate at maximum licensed power of 61dBm/5MHz at a height of 20m above local ground level. A maximum range of the interference source of 200km has been assumed. The modelling assumes the full bandwidth available in the 2.6 GHz band is being used.

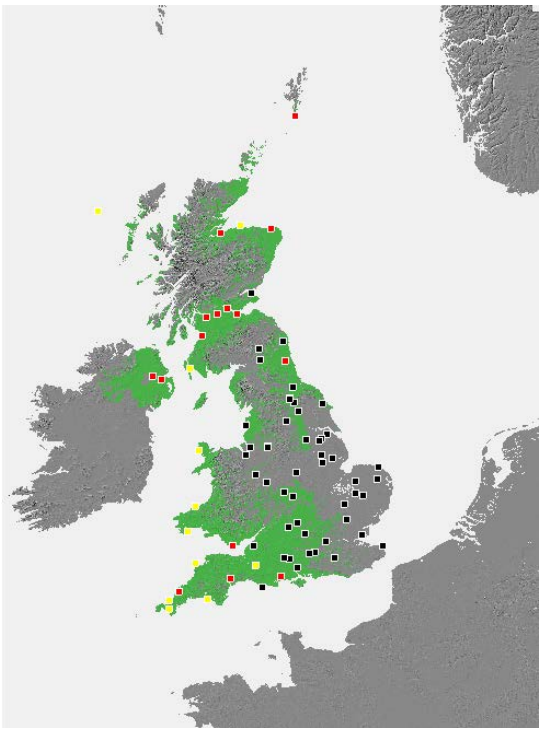
3.78 The green area indicates where for these assumptions the radar protection threshold (-74dBm/m^2) would be exceeded, and the 2.6 GHz licensee would have to take some action in order to be able to deploy (e.g. alteration to the base station or local agreement with the radar operator).

3.79 Civil radars are shown on the maps in red, military radars are shown in yellow and radars which have been modified are shown in black. Modified radars still have some restricted areas but in general this cannot be seen on the maps since the post-modification restricted area is localised very close to the radar.



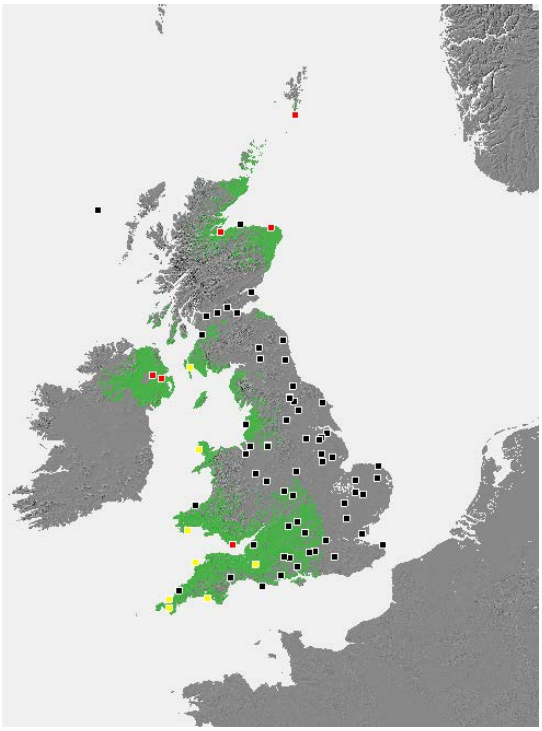
Quarter	Prior to start of roll-out
Calculation range	200km
Comms transmit power per channel dBm (EIRP)	61
Number of channels	24
Radar threshold pre-mod	-74dBm/m^2
Radar threshold post-mod	5dBm/m^2

Figure 3.4: Prior to roll out of modifications



Quarter	End of Q3 2013
Calculation range	200km
Comms transmit power per channel dBm (EIRP)	61
Number of channels	24
Radar threshold pre-mod	-74dBm/m^2
Radar threshold post-mod	5dBm/m^2

Figure 3.5: End Q3 2013



Quarter	End of Q4 2013
Calculation range	200km
Comms transmit power per channel dBm (EIRP)	61
Number of channels	24
Radar threshold pre-mod	-74dBm/m^2
Radar threshold post-mod	5dBm/m^2

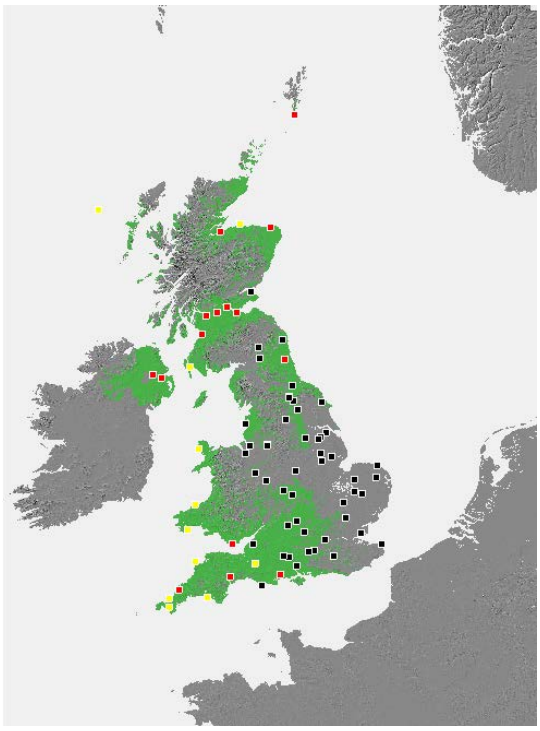
Figure 3.6: End Q4 2013

Quarter	End of Q1 2014
Calculation range	200km
Comms transmit power per channel dBm (EIRP)	61
Number of channels	24
Radar threshold pre-mod	-74dBm/m^2
Radar threshold post-mod	5dBm/m^2

Figure 3.7: End Q1 2014

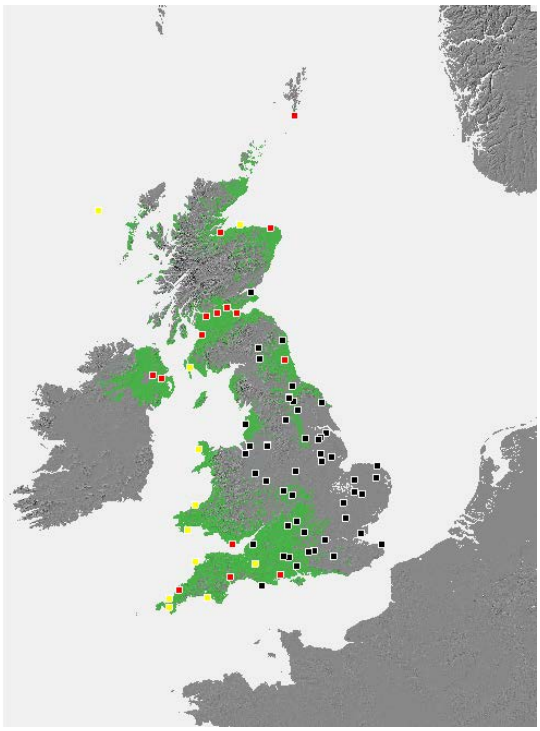
Threshold for in-communications-band signals – changes in base station power

3.80 The following maps have been produced using the same ICS Telecom with ITU-R P.452 propagation model but we have assumed a range of decreasing base station powers, at a height of 20m above local ground level. A maximum range of the interference source of 200km has been assumed. The modelling assumes the full bandwidth available in the 2.6 GHz band is being used.



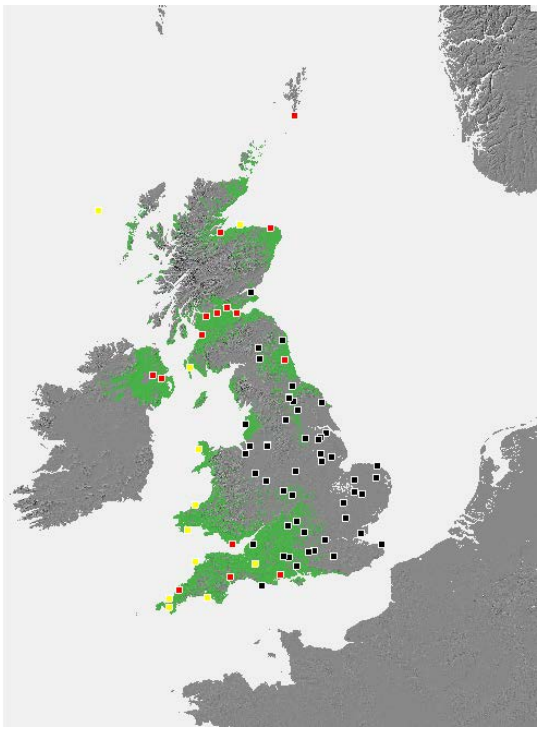
Quarter	End of Q3 2013
Calculation range	200km
Comms transmit power per channel dBm (EIRP)	61
Number of channels	24
Radar threshold pre-mod	-74dBm/m^2
Radar threshold post-mod	5dBm/m^2

Figure 3.8: End Q3 2013, 61dBm EIRP



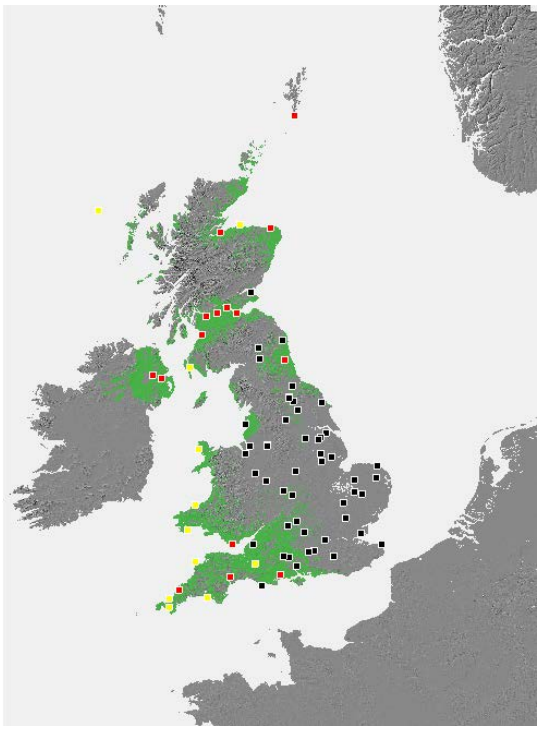
Quarter	End of Q3 2013
Calculation range	200km
Comms transmit power per channel dBm (EIRP)	55
Number of channels	24
Radar threshold pre-mod	-74dBm/m^2
Radar threshold post-mod	5dBm/m^2

Figure 3.9: End Q3 2013, 55dBm EIRP



Quarter	End of Q3 2013
Calculation range	200km
Comms transmit power per channel dBm (EIRP)	51
Number of channels	24
Radar threshold pre-mod	-74dBm/m^2
Radar threshold post-mod	5dBm/m^2

Figure 3.10: End Q3 2013, 51dBm EIRP



Quarter	End of Q3 2013
Calculation range	200km
Comms transmit power per channel dBm (EIRP)	46
Number of channels	24
Radar threshold pre-mod	-74dBm/m^2
Radar threshold post-mod	5dBm/m^2

Figure 3.11: End Q3 2013, 46dBm EIRP

Threshold for out of band emissions

3.81 The following maps have been produced using the same ICS Telecom with ITU-R P.452 propagation model.

3.82 In Figure 3.12 below, it has been assumed that base stations operate at the maximum regulatory communications OOB emissions (noise) limit of -45dBm/MHz EIRP per provider with 5 providers in the 2.6 GHz band, at a height of 20m above local ground level. A maximum range of the interference source of 200km has been assumed. The modelling assumes the full bandwidth available in the 2.6 GHz band is being used.

3.83 The green area indicates where for these assumptions the radar noise protection threshold would be exceeded and the 2.6 GHz licensee would need to take some action to modify the deployment in order to be able to deploy. The radar noise protection threshold remains the same both pre and post radar modification. Note that the map shows only England and Wales since the restricted area is localised closer to the radar than in the previous in-band interference maps.

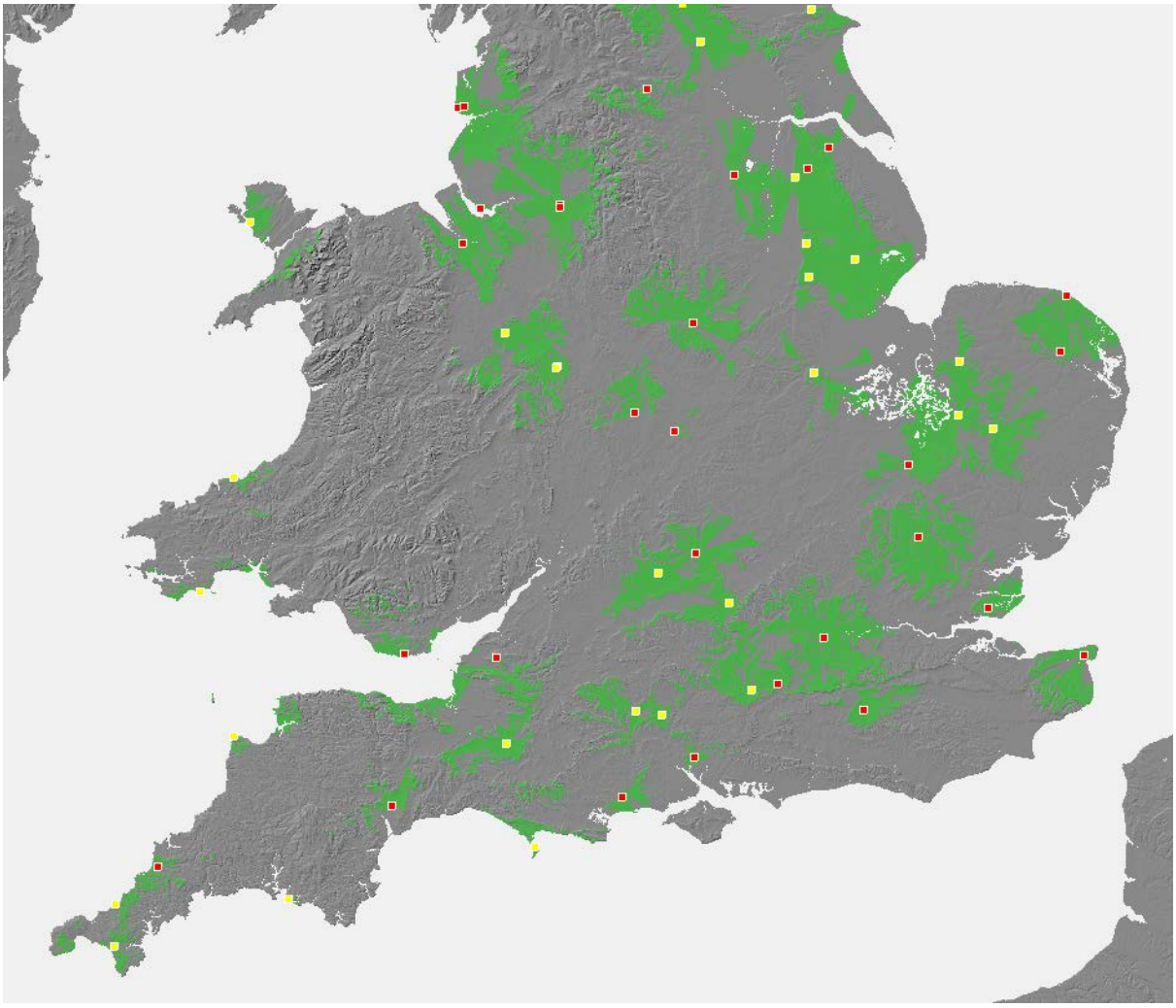


Figure 3.12: Coordination ranges for -45dBm/MHz EIRP OOB

3.84 In Figure 3.13 below it has been assumed that base station OOB emissions are below the regulatory limit. It is assumed that base station OOB emissions are -70dBm/MHz EIRP per provider with 5 providers in the 2.6 GHz band, at a height of 20m above local ground level. A maximum range of the interference source of 200km has been assumed. The modelling assumes the full bandwidth available in the 2.6 GHz band is being used.

3.85 The green area indicates where for these assumptions the radar noise protection threshold would be exceeded and the 2.6 GHz licensee would need to take some action in order to be able to deploy. The radar noise protection threshold remains the same both pre- and post-radar modification. Note that the map has been significantly zoomed in to show only Heathrow and Northolt radars since the restricted area is very localised close to the radar.

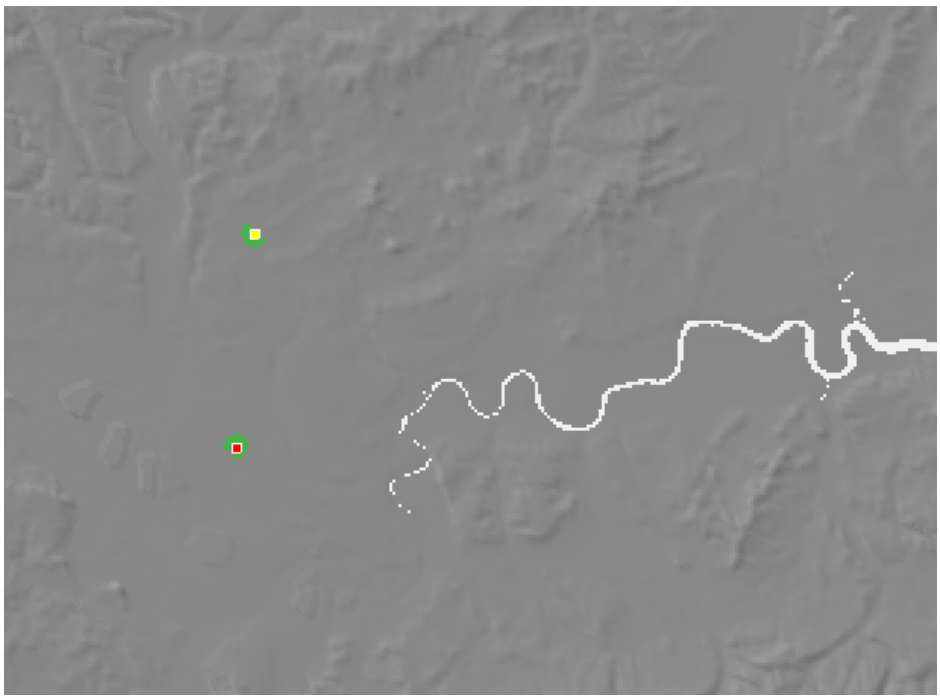


Figure 3.13 Coordination ranges for -70dBm/MHz EIRP OOB

Relevant conditions in 2.6 GHz licences

3.86 There is a condition in licences for the 2.6 GHz band requiring the Licensee to comply with such coordination procedures as may be notified to it by Ofcom from time to time.

Deployment of LTE at airports

3.87 We commissioned a study to consider specifically deployment of LTE mobile services at airports. In July 2011, we published the Airport Deployment Study[43], which considered the potential airport deployments of mobile broadband technology in the 2.6 GHz band and its potential interference impact on nearby radars operated in the S- band. The results indicate deployments of radio equipment in the 2.6 GHz band are feasible with sensible measures in and around airports.

[43] http://www.ofcom.org.uk/static/spectrum/Airport_Deployment_Study.pdf

PMSE use in 2.6 GHz

3.88 The 2.6 GHz band is currently licensed for PMSE use. Short-term PMSE licences for use in the band are currently available but access to these frequencies for PMSE will cease on three months' notice. This three months' notice will be triggered when we announce the provisional application date to participate in the Award Process. PMSE use of the band after expiry of the three months' notice will be unlawful and liable to enforcement action by us.

Section 4

The licences

Introduction and summary

4.1 In this section we summarise some of the licence conditions we will include in the Licences to be awarded to the winning bidders.

4.2 For the avoidance of doubt the Licences will not guarantee exclusive use of the spectrum awarded. In the future we may grant additional authorisations to allow the use of all, or part, of the spectrum, including the spectrum that is the subject of this Award Process. We would develop and consult on the conditions of use under any such additional authorisations in order to manage the risk of harmful interference.

4.3 The Licences will contain only those technology and usage restrictions that are in our view proportionate and necessary for spectrum management reasons to manage the risk of harmful interference and to ensure compliance with our statutory duties and international obligations. It should be noted, however, that the services that a Licensee intends to offer may be constrained by regulation of downstream services (at retail or wholesale level) such as the General Conditions of Entitlement under the Communications Act 2003 and other legislation. Potential Bidders should seek their own advice in this regard.

4.4 Ofcom is also not placing any limitation on its scope for authorising others to use spectrum to offer such services. Such authorisation may occur, for example, by way of the grant of new licences, decisions as to the variation of existing licences, or decisions as to exemptions from licensing.

4.5 The Licences will be awarded under the WT Act. Each Licence grants the Licensee the right to establish, install and use radio equipment in accordance with specific technical parameters set out in the Licence for an indefinite term (see paragraph 4.8). The Licence also sets out the conditions that apply to the Licensee in respect of:

- the circumstances in which we may revoke the Licence (see paragraph 4.10)
- Licence variation (see paragraphs 4.12 to 4.13);
- fees (see paragraphs 4.15 to 4.16); and
- modification, restriction and closedown (see paragraphs 4.18 to 4.19).

We explain below in paragraphs 4.21 to 4.28 how spectrum trading applies to the Licence.

4.6 We have not summarised all of the licence terms in this section, and in particular have not summarised the technical parameters to be included in the schedules to the Licences. However, a draft template Licence is annexed to this Memorandum at Annex 1. The draft schedules to the draft template Licence are at Annex 2 to this Memorandum as follows:

- Annex 2A: 800 MHz band – No coverage obligation;
- Annex 2B: 800 MHz band – Coverage obligation;

- Annex 2C: 1800 MHz band;
- Annex 2D: 2.6 GHz band – Paired spectrum;
- Annex 2E: 2.6 GHz band – Unpaired spectrum;
- Annex 2F: 2.6 GHz band – Low power use;

4.7 Potential Bidders should review these documents carefully and seek their own advice as appropriate. Each Licensee will be granted a single Licence with one or more schedules reflecting the frequency bands awarded to it in accordance with the Award Process.

Term, revocation and variation

4.8 Each Licence will have an indefinite term and will continue in force from the date of grant until revoked by Ofcom or surrendered by the Licensee.

4.9 The licence will include an initial term (the Initial Term) lasting 20 years from the date of issue of the licence, during which there will be limited rights of revocation. After the Initial Term, Ofcom will be able to revoke the licence for spectrum management reasons, provided we have given the Licensee at least five years' notice.

4.10 The Licence can also be revoked, including during the Initial Term, in the following circumstances:

- at the request or with the consent of the Licensee;
- if there has been a breach of any of the terms of the Licence;
- if it appears to be requisite or necessary or expedient to do so in the interests of national security or for the purposes of complying with an international obligation of the UK;
- if it appears requisite or necessary or expedient to do so for the purpose of complying with a direction by the Secretary of State to us under section 5 of the Communications Act 2003 or section 5 of the WT Act;
- if the Licensee has not complied with any requirement of any relevant trading regulations; or
- if the Licensee has not complied with certain requirements of the Regulations.

4.11 For a Licence that includes spectrum in the 1800 MHz band only, that Licence can also be revoked if the Licensee is not approved as a Purchaser (as defined in the Commitments) in accordance with Section D of the Commitments.

4.12 Where we propose to vary or revoke a Licence, we must follow the procedure in paragraphs 6, 6A and 7 of Schedule 1 to the WT Act. The notice under the WT Act must state the reasons for the proposed variation or revocation and specify a period during which the Licensee may make representations, or where the notice relates to a failure to observe licence conditions, meet those licence conditions.

4.13 Any variation of the Licence will be in accordance with the requirements of the WT Act.

Changes to Licensee's details

4.14 The Licensee must give prior notice to us in writing of any proposed changes to the Licensee's name and address.

Sum Payable for the Licence

4.15 The sum payable in respect of each Licence will be determined through the Award Process in accordance with the Regulations.

Licence fee after the Initial Term

4.16 Licensees will be liable to pay additional licence fees in respect of the Licences if they continue to hold them after the end of the Initial Term. The level of these fees will depend on our general approach to fees for the use of spectrum at the relevant time, and how that general approach relates to these Licences and to our statutory duties at that time. The level of the fees cannot therefore be determined now. Note that we would expect to give prior notice of our specific proposals to charge fees, and to consult as appropriate, before fees are introduced.

Access and inspection

4.17 Licensees will be required to permit any person authorised by Ofcom to have access to and to inspect the radio equipment specified in the Licence at all reasonable times (or, when an urgent situation arises, at any time) to ensure that the Licensee is using the radio equipment in accordance with the conditions of the Licence. The Licensee must also permit access at any time to the radio equipment specified in the Licence to any person authorised by Ofcom when an urgent situation arises.

Modification restriction and closedown

4.18 We may require the radio equipment or any part of it to be modified, restricted in use or temporarily or permanently closed down if:

- a Licensee has breached the terms of its Licence; and/or
- use of radio equipment is or may be causing or contributing interference to the operation of other authorised radio equipment.

4.19 We may also require the radio equipment to be modified, restricted in use or temporarily or permanently closed down if it appears to be requisite or expedient to do so in the event of a national or local state of emergency. We may only exercise this power after a written notice has been served on the Licensee or a general notice applicable to holders of a named class of Licence has been published.

Territorial extent of Licences

4.20 Subject to any restrictions imposed by any coordination procedures, including those listed at paragraph 4.31 below, the Licences will permit use within the UK. They will not permit use in the Channel Islands or the Isle of Man.

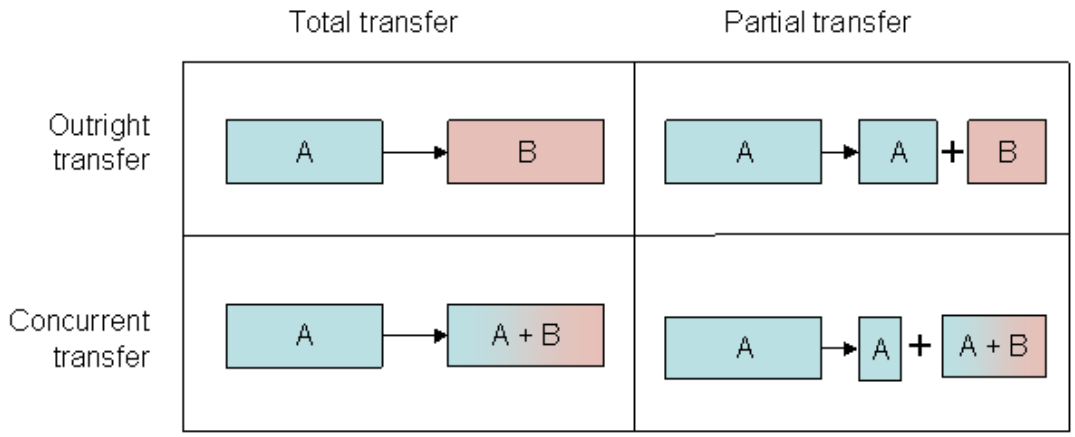
Spectrum trading

4.21 A Licensee cannot assign its Licence to another party, but it may transfer the rights and obligations to another person under the spectrum trading regime. We began the implementation of spectrum trading for selected licence classes in 2004, through the Wireless Telegraphy (Spectrum Trading) Regulations 2004[44] (the Spectrum Trading Regulations). The Spectrum Trading Regulations introduced the possibility for licensees in specific classes to carry out:

- outright total transfers, i.e. transfers of all of the rights and obligations arising under a licence to a third party;
- concurrent total transfers, i.e. transfers of all of the rights and obligations arising under a licence to a third party which result in a concurrent holding of those rights and obligations by the transferor and the transferee(s);
- outright partial transfers, i.e. outright transfers of some of the rights and obligations arising under a licence to a third party; and
- concurrent partial transfers, i.e. transfers of some of the rights and obligations arising under a licence to a third party which results in a concurrent holding of those partial rights and obligations by the transferor and the transferee(s).

4.22 Figure 4.1 illustrates these four generic types of transfer.

Figure 4.1 Illustration of some possible types of transfer



Source: Spectrum Trading Guidance Notes - *http://stakeholders.ofcom.org.uk/spectrum/spectrum-trading/trading-guidance-notes/*

4.23 We describe this process as 'transfer' because the spectrum access rights are transferred by the grant of a new licence.

4.24 The Spectrum Trading Regulations did not extend to the 900 MHz, 1800 MHz and 2100 MHz bands. On 20 December 2010, the Secretary of State made a Direction pursuant to section 5 of the WT Act, which among other things required us to make new regulations to extend trading to these bands. We published a notice[45] on 2

[44] http://www.legislation.gov.uk/uksi/2004/3154/contents/made
[45] http://stakeholders.ofcom.org.uk/consultations/trading-900-1800-2100/

February 2011 setting out how we proposed to do this. We proposed that all types of transfer would be permitted. We also proposed providing in the new regulations for us to be able, before consenting to a transfer, to undertake an *ex ante* competition check where we considered this appropriate. On 20 June 2011 we published a statement setting out our decision to extend trading to these bands[46]. The Wireless Telegraphy (Mobile Spectrum Trading) Regulations 2011 (the Mobile Spectrum Trading Regulations) came into force on 4 July 2011[47].

4.25 We will amend the Mobile Spectrum Trading Regulations to extend its provisions to the 800 MHz and 2.6 GHz bands, so that:

- the rights and obligations under Licences in these bands will be tradable;
- with the exception of any Licences awarded for low power use in the 2.6 GHz band, all types of transfer will be permitted;
- our consent will be required for a transfer; and
- before giving consent we may undertake an *ex ante* competition check.

4.26 The position will be slightly different for any Licences that we may award which include shared low-power use in the 2.6 GHz band. We will not allow transfers that would increase the total number of 2.6 GHz low-power Licensees, i.e.

- concurrent total transfers, i.e. transfers of all of the rights and obligations arising under a licence, to a third party which result in a concurrent holding of those rights and obligations by the transferor and the transferee(s);
- outright partial transfers, i.e. outright transfers of some of the rights and obligations arising under a licence to a third party; and
- concurrent partial transfers, i.e. transfers of some of the rights and obligations arising under a licence to a third party that results in a concurrent holding of those partial rights and obligations by the transferor and the transferee(s).

4.27 On 22 September 2009 we published a consultation[48] on proposals to streamline the spectrum trading process by, among other things, introducing a new type of trading called 'spectrum leasing', in which spectrum could be accessed by entering into a lease with a licensee without obtaining a new licence from Ofcom. When parties enter into a lease, the licence remains in the hands of the original holder. In a statement following the consultation we set out our decision to introduce spectrum leasing[49]. At present leasing is permitted for a limited set of licence classes - Area Defined Business Radio licences, Suppliers Light Business Radio licences and most licences awarded following an auction. We will consider after the Award Process whether to allow leasing for mobile spectrum licences, i.e. licences for the 900 MHz, 1800 MHz and 2100 MHz bands, as well as Licences in the 800 MHz and 2.6 GHz bands.

4.28 We provide guidance on our website on the spectrum trading process – see http://stakeholders.ofcom.org.uk/spectrum/spectrum-trading/trading-guidance-notes/

[46] http://stakeholders.ofcom.org.uk/consultations/trading-900-1800-2100/statement/
[47] http://www.legislation.gov.uk/uksi/2011/1507/contents/made
[48] http://stakeholders.ofcom.org.uk/binaries/consultations/simplify/summary/simplify.pdf
[49] http://stakeholders.ofcom.org.uk/binaries/consultations/simplify/statement/statement.pdf

Non-technical restrictions on use

4.29 We do not propose to impose any non-technical restrictions on the use to which the spectrum could be put in the Licences (such as specifying the type of service that should be offered, the technology that should be deployed or the equipment that should be used), apart from an obligation on mobile broadband coverage described in paragraph 4.32 below.

Coordination Procedures

4.30 Licensees will be required to comply with any coordination procedures that are notified to them by Ofcom from time to time.

4.31 Ofcom intends to notify Licensees of the following coordination procedures at the time of initial grant of the Licences:

- For Licences that include spectrum in the 2.6 GHz band, 2.6/Radar coordination procedures. A draft of the Notice is annexed to this Memorandum at Annex 3. Please also see the discussion of this issue at paragraphs 3.47 to 3.87 of this Memorandum.

- For Licences that include spectrum in the 2.6 GHz band, 2.6/restricted block procedures. A draft of the Notice is annexed to this Memorandum at Annex 4.

- For Licences that include spectrum in the 800 MHz band, 800 MHz/DTT co-existence. A draft of the Notice is annexed to this Memorandum at Annex 5. Please also see the summary of this issue at paragraphs 3.13 to 3.16 of this Memorandum.

- For Licences that include spectrum in the 800 MHz band, 800 MHz/DTT transitional requirements. A draft of the Notice is annexed to this Memorandum at Annex 6. Please also see the summary of this issue at paragraphs 3.2 to 3.11 of this Memorandum.

Coverage obligation

4.32 One of the Licences will include a coverage obligation. This will be the Licence that will authorise use of the frequencies 811 to 821 MHz paired with 852 to 862 MHz. The coverage obligation is set out in the draft schedule at Annex 2B to this Memorandum.

4.33 The arrangements for monitoring compliance with the obligation are set out in a compliance verification methodology document that we are publishing alongside this Memorandum.

Provision of information to facilitate optimal spectrum use

4.34 A condition in the Licence will require Licensees to provide us on request with certain specified information regarding their use of radio equipment.

Section 5

The licences – conditions relating to DTT Coexistence

5.1 Ofcom will notify the 800 MHz Licensees of the DTT Interference Mitigation Procedures at Annex 5 relating to the need to manage interference from new services in the 800 MHz band to the reception of existing DTT services below 790 MHz. The 800 MHz Licensees will be required to comply with the DTT Interference Mitigation Procedures by a term in their Licences. For the purpose of this section, references to the DTT Interference Mitigation Procedures also include any specific licence conditions relating to this issue.

5.2 The 800 MHz Licensees will be required collectively to deliver a single consumer help scheme to households whose primary means of reception of television services is by means of digital terrestrial transmission, and whose reception of such services is disrupted by the transmission of mobile services by the 800 MHz Licensees.

5.3 The consumer help scheme (which we refer to as 'MitCo' for the purposes of this Memorandum) will need to be consistent with the decisions made by Government as announced on 21 February 2012[50] (described in Section 3 of the second consultation on DTT Coexistence published on 23 February 2012), and further Government decisions published on 10 July 2012 [51].

5.4 The 800 MHz Licensees will be required to operate MitCo according to a set of key performance indicators (KPIs). They will also need to prepare and agree a Code of Service and ensure that MitCo is operated in accordance with that Code. The Code itself will set out MitCo's service commitment to consumers. We discuss KPIs and the Code of Service further below and provide full details of the KPIs in A6.145 to A6.218 of Annex 6 of the Statement, and on the Code of Service at A6.242 to A6.248 of Annex 6 of the Statement.

5.5 Government does not currently intend to establish MitCo as a legal entity in advance of the Award Process. Instead, it will be the responsibility of the 800 MHz Licensees to establish the appropriate legal entity to discharge the mitigation activity defined in the licence conditions.

5.6 Following the publication of this Memorandum, Government intends to appoint a person or persons to carry out preparatory work in advance of the Award Process. This work will, among other things, produce a draft approach and set of rules for the establishment and governance of MitCo. The 800 MHz Licensees will have the option of cooperating together to agree their own approach to establishing MitCo and a different set of rules for owning and operating it, if they see fit, subject to any such alternative approach and rules being agreed by all licensees within six weeks of the date of Licences being granted. The Licensees may make a request to Ofcom to extend this timescale if they unanimously agree to do so, and Ofcom will consider any such application and make a decision on extension as soon as practicable after any request is made. If either (i) the 800 MHz Licensees have not requested an extension, or (ii) MitCo has not been set up by this date, the 800

[50] http://www.culture.gov.uk/news/media_releases/8865.aspx
[51] http://www.culture.gov.uk/images/publications/letter-dcms-ofcom-10072012.pdf.

MHz Licensees will be required to use the approach and rules prepared in advance. In any event and within the same timescale, MitCo must be able to nominate a senior responsible person to represent MitCo on the Oversight Board.

5.7 An Oversight Board (OB) will be established by Government to oversee and monitor MitCo's performance in providing the consumer help scheme. We discuss this in more detail in paragraphs 5.18 to 5.26.

5.8 The following subsections provide more detail on:

- preparations for MitCo;
- funding and gainshare;
- the OB;
- managing MitCo's performance;
- other conditions; and
- closure of MitCo

Preparations for MitCo

5.9 As noted above, following the publication of this Memorandum, Government intends to appoint a person or persons to carry out preparatory work in advance of the Award Process. The preparatory work will be conducted in an open manner, working with relevant stakeholders, including potential bidders for the 800 MHz licences. Its purpose is to minimise the time that will be needed for MitCo to become operational at scale, i.e. to be in a position to provide consumer support in line with the KPIs over a sufficiently large geographical area to fit with licensee roll-out plans.

5.10 This preparatory work undertaken by, or on behalf of, Government will not establish a legal entity. It will produce a package of documents which will be made available to the 800 MHz Licensees to use if they wish (or as a fall-back in the event that the licensees do not agree arrangements between themselves). It will include draft governance documentation that could be used by the 800 MHz Licensees for setting up MitCo, which may include a Memorandum and Articles of Association and proposals for governance of MitCo, including membership of any decision making board. It will also include research into, and early scoping of, operational aspects of MitCo's potential work including, for example, identification of potential sub-contractors for delivering elements of MitCo's work. The work will need to strike an appropriate balance between enabling MitCo to be up and running quickly after licence award and providing opportunity for licensees to shape MitCo in the way they see fit.

Funding and gainshare

Funding

5.11 The Government has decided that licensees should provide funding totalling £180m to fund the provision of consumer support in relation to mitigating interference into DTT from the use of new services in the 800 MHz band.

5.12 This funding does not cover any costs the 800 MHz Licensees may choose to incur in undertaking network-based mitigation on their own networks. However, to the extent that the 800 MHz Licensees can avoid consumer-based mitigation costs by carrying out network-based mitigation, they will benefit through the gainshare mechanism.

5.13 Each 800 MHz Licensee will be required to pay an amount totalling £30million per 2x5 MHz of paired 800 MHz spectrum to such bank accounts as notified to it by Ofcom. The payments shall be made as follows:

- £20million per 2x5 MHz of paired 800 MHz spectrum held must be paid within 14 days of MitCo being set up as a legal entity;
- £5million per 2x5 MHz of paired 800 MHz spectrum must be paid one year after the first payment is made; and
- £5million per 2x5 MHz of paired 800 MHz spectrum must be paid two years after the first payment is made.

5.14 These sums will be used to fund both the consumer help scheme operated by MitCo and the work of the OB. The funding that the 800 MHz Licensees will be required to provide for the work of the OB will be a total of £1.2m per annum.

5.15 Ofcom may require that the sums referred to in 5.13 shall be paid into more than one bank account provided that the total payable shall not exceed the total amounts set out above.

5.16 If the total outturn cost of providing the consumer help scheme through running MitCo and the OB is more than £180m, the 800 MHz Licensees will not be required to provide any necessary additional funding, except where the reason the cost exceeds £180m is because the 800 MHz Licensees have chosen to provide help not required or approved by Government.

Gainshare

5.17 In the event that MitCo and the OB's total outturn expenditure is less than £180m, the residual funds will be subject to a "gainshare" mechanism. The residual funds will be returned in full to the 800 MHz Licensees and shared between them. The funds payable to each 800 MHz licensee shall be calculated in proportion to the percentage of the total frequencies in the 800 MHz band covered by that 800 MHz Licensee's Licence as at the date on which the Licence was granted. However, 800 MHz Licensees may seek to negotiate an alternative split subject to unanimous agreement between themselves.

The Oversight Board

5.18 An OB will be established by Government to oversee and monitor MitCo's performance in providing the consumer help scheme. It will be an advisory group with responsibility for providing guidance and recommendations to MitCo relating to its performance. Although it will have no statutory powers, it will make recommendations to Ofcom with respect to any action, including enforcement action, in relation to the mitigation of interference to DTT from the use of the 800 MHz band. Government will make its final decisions on the core functions of the OB. The current position is that the OB will:

- monitor MitCo's performance on an ongoing basis against the KPIs, Code of Service and other requirements of the DTT Interference Mitigation Procedures;

- advise and make recommendations to MitCo in relation to MitCo's performance against its KPIs, Code of Service and other requirements of the DTT Interference Mitigation Procedures; and

- advise, report to, and make recommendations to Ofcom in relation to MitCo's performance against its KPIs, Code of Service and other requirements of the DTT Interference Mitigation Procedures.

5.19 The OB will be led by a Chairperson who will be an independent appointment made by Government to deliver the remit of the OB. The following table outlines the senior membership for the OB:

Table 5.1: Senior membership for the Oversight Board

Membership	Role	Voting status
Chairperson	Independent chair of the OB	Casting vote
Senior responsible person from MitCo, e.g. the Chief Executive Officer	Represents the management of MitCo	Non-voting status, information provider
Government (DCMS)	Represents Government wide interests as the responsible department for public policy	Non-voting status, observer
Ofcom	Represents the authority with responsibility for managing the spectrum and enforcing the licence conditions	Non-voting status, observer
Independent 1	Provides constructive challenge to help develop the Oversight Board's recommendations with regards to technical and performance aspects	Voting status
Independent 2	Provides constructive challenge to help develop the Oversight Board's recommendations with regards to protecting consumer interests	Voting status
Broadcasting Representatives *(number to be determined by Government)*	Represent the interests of the broadcasting industry	Voting status for each representative
800 MHz Licensees *(number to be determined by Government)*	Represent the 800 MHz licensees	Voting status for each representative

5.20 The overarching principle for the composition of the OB is that there is balance between the representation of 800 MHz Licensees and broadcasting

representatives. Given the uncertainty around the number of licensees at this stage, the number and nature of representation from the broadcast community will be confirmed by Government following the Award Process. Each 800 MHz Licensee will be individually required to appoint a senior member from within its organisation who will act as its representative on the OB.

5.21 Two independent representatives will be appointments made by Government to serve on the OB. They are expected to play a similar role to non-executive directors on a company board and will be an important method of ensuring balanced decision making that avoids placing too much emphasis on the casting vote of the Chairperson. It is expected that the independents will together bring sufficient technical and consumer understanding to discharge their roles as independent advisors.

5.22 Voting amongst members will be on an equal basis with one vote per representative, and a casting vote exercised by the Chairperson. Advice to Ofcom on the basis of OB deliberations will be determined by simple majority voting.

5.23 In addition to those afforded observer status, the OB Chairperson will reserve the right to invite additional relevant stakeholders to attend Board meetings or to convene a separate meeting with a wider group of stakeholders as necessary.

5.24 The OB will meet on a monthly basis or as otherwise called by the Chairperson, e.g. based on advice from expert resources.

5.25 The OB is likely to need the support of expert resources to enable it to fulfil its core functions, e.g.:

- Support for the Chair of the OB and its members in, for example, preparing information, managing meetings etc;
- Technical modelling capability; and
- Audit capability.

5.26 It is expected that the budget for the OB will be managed separately to that of MitCo and that the management of the OB's budget will be the responsibility of the Chairperson.

Managing MitCo's performance

Key Performance Indicators

5.27 MitCo's performance will be monitored by the OB, which will assess MitCo's delivery of the consumer help scheme against KPIs and provide advice to Ofcom, as appropriate, on the enforcement of particular obligations to which licensees are subject under their licences.

5.28 The purpose of the KPIs is to provide a minimum, guaranteed level of service that consumers should expect from the consumer help scheme to be operated by MitCo in line with Government decisions.

5.29 Under the consumer support level that has been chosen by Government, the consumer help scheme operated by MitCo will principally involve:

- The supply of advice and information to all households forecast to be at risk of interference to their DTT services;

- The distribution of filters to primary DTT households predicted to be affected by DTT interference (with emphasis on supplying filters prior to interference occurring);

- Support to primary DTT households which contain residents deemed to be vulnerable, where the definition of vulnerability aligns with that used by the Digital Switchover Help Scheme[52], including through the installation of filters; and

- Provision of platform changes to primary DTT households where the provision of a receiver filter is ineffective in resolving interference issues; and

- Provision of installation support in the form of vouchers (to a value of £50 + VAT) to primary DTT households affected by interference whose TV installation comprises a mast-head amplifier.

5.30 The KPI framework developed to manage the consumer help scheme to be delivered by MitCo is structured around this scope of activities. The full set of KPIs is set out in Annex 2 of the 'DTT Interference Mitigation Procedures.

5.31 The 800 MHz Licensees will be collectively responsible for ensuring MitCo complies with the KPIs.

5.32 It will be the role of the OB to monitor and assess the performance of MitCo against the KPIs (see below) and make recommendations to Ofcom as to whether the 800 MHz Licensees, through their control of MitCo, are acting in accordance with their Licences.

Operational Conditions

5.33 In the event that MitCo fails to achieve the performance standard set in a KPI (the "Standard"), an Operational Condition (OC) will automatically apply to the 800 MHz licensees with respect to that particular KPI. The 800 MHz Licensees will be jointly responsible for meeting KPIs via MitCo and, therefore, OCs attached to the KPIs will apply to each 800 MHz Licensee equally and all licensees will be required to implement them.

5.34 The OCs that would take effect in the event of failure to meet a KPI are set out in Annex 2 of the DTT Interference Mitigation Procedures.

KPI monitoring and assurance

5.35 MitCo will be required to provide regular reports on its performance against KPI Standards to the OB in line with the reporting requirements set out in the licence conditions. The performance reports will need to flag areas of non-compliance with the KPIs.

[52] The DSHS' eligibility criteria are as follows: aged 75 or over; or lived in a care home for six months or more; or eligible for either Disability Living Allowance (DLA), Attendance allowance, Constant Attendance Allowance or Mobility supplement; or registered blind or partially sighted.

5.36 In addition, the OB audit function will undertake audits of MitCo's actual performance based on access to MitCo databases and random sampling of customer service activities.

KPI and Operational Conditions change process

5.37 It will be possible for MitCo or the OB, or members of the OB, to propose changes to KPIs and/or OCs. Any such proposals must be considered by the OB, which, subject to the voting procedures set out above, will make recommendations to Ofcom. Ofcom will be responsible for making any decisions to modify any of the KPIs or OCs, subject first to any procedural requirements being met.

5.38 Modifications to KPIs and OCs will be limited to the ranges specified in the tables in Annex 3 of the DTT Interference Mitigation Procedures.

Other conditions

5.39 In addition to the conditions outlined above, a number of other conditions will be included in the DTT Interference Mitigation Procedures to ensure MitCo provides the appropriate outcomes for eligible households experiencing DTT interference. We describe these conditions in the following paragraphs.

Bespoke mitigation

5.40 One of the decisions made by Government in February 2012 was that households who experience interference which cannot be resolved with a filter and who cannot access an alternative platform should receive additional assistance to restore some form of TV service. MitCo will be required to spend up to £10,000 per affected household in providing this additional assistance. A condition will be included in the DTT Interference Mitigation Procedures to require 800 MHz Licensees to provide this support.

Provision of additional installation support

5.41 In its letter of July 2012, Government decided that up to £12m of MitCo's funding should be set aside to fund the provision of installation support to primary DTT households (in addition to the installation support required for vulnerable consumers) whose reception of DTT services is affected by interference and whose TV installation employs a mast-head amplifier and where the installation is not part of a communal aerial system.

5.42 A condition will be included in the DTT Interference Mitigation Procedures to require 800 MHz Licensees to provide monetary assistance, e.g. through a voucher scheme, to DTT households fitting the above description which is not less than £50 plus VAT per household.

Cooperation with the OB

5.43 The 800 MHz Licensees will be required to establish an MoU between MitCo and the OB before MitCo commences operation, i.e. before it starts communicating with, and providing support to, consumers. This MoU must cover expected interactions between MitCo and the OB and agreed ways of working.

5.44 If the 800 MHz Licensees have not agreed a MoU among themselves and with the OB within 6 weeks of the date of their Licences being granted, licensees will be

required to adopt a MoU notified to them by Ofcom. However, the licensees may make a request to Ofcom to extend this timescale if they unanimously agree to do so, and Ofcom will consider any such application and make a decision on extension as soon as practicable after any request is made.

5.45 In the Statement, in paragraphs A6.141 to A6.144 of Annex 6, we describe the elements which we consider should be included in the MoU.

Code of Service for interaction with consumers

5.46 The 800 MHz Licensees will be required to produce a Code of Service which sets out MitCo's service commitments to its consumers. We expect that the Code of Service will be based on the principles, and include the elements, described in the Statement in paragraphs A6.242 to A6.248 of Annex 6.

5.47 Specifically, the 800 MHz Licensees will be required to do the following in advance of commencing communications with consumers:

- jointly prepare and agree a Code of Service among themselves;
- ensure that MitCo consults with the OB on the Code of Service and takes due account of the OB's advice and views on the content of the Code of Service; and
- ensure that the Code of Service is published openly, for example in MitCo's key communications and on its website.

5.48 If the 800 MHz Licensees have been unable to agree on a Code of Service within 6 weeks of the date of their Licences being granted, they will be required to adopt a Code of Service notified to them by Ofcom. However, the 800 MHz Licensees may make a request to Ofcom to extend this timescale if they unanimously agree to do so, and Ofcom will consider any such application and make a decision on extension as soon as practicable after any request is made.

Interference forecasting

5.49 MitCo will need to use an interference forecasting model to predict levels of interference to DTT receivers. This model could potentially be in a form similar to the model used by Ofcom to generate interference forecasts.

5.50 As performance against KPIs will be based on this model, it is important that the model is as accurate as possible, is independently verified and that all parties use the same model. 800 MHz Licensees will be required, via MitCo, to consult with the OB on, and agree with Ofcom, the underlying algorithms and input parameters used in the model before the model is used for the purposes of interference modelling.

5.51 The 800 MHz Licensees, via MitCo, will also be required to consult with the OB on, and agree with Ofcom, any amendments to the forecasting model. They must also make arrangements so that the OB technical function can audit the model and make recommendations to Ofcom accordingly. This would include providing access to the software, input parameters and underlying algorithms used within the model as and when required.

DTT receiver filters

5.52 The 800 MHz Licensees will be required, through the consumer help scheme delivered by MitCo, to provide receiver filters as the primary mitigation technique used to mitigate interference for DTT consumers.

Complaints procedure

5.53 The 800 MHz Licensees will be required, via MitCo, to consult with, and take due account of the views of, the OB in relation to establishing a consumer complaints-handling procedure, and put this procedure in place in advance of commencing communications with consumers. The procedure will need to set out how MitCo will act to resolve the generality of complaints it receives. The procedure will also need to set out how complaints which are not resolved to the consumer's satisfaction within a specified time period would be escalated to a separate body, e.g. an alternative dispute resolution scheme. Additionally, the procedure will need to specify what actions MitCo would commit to take if the separate body found that MitCo had failed to respond to or deal with the consumer complaint in an appropriate manner. Licensees will further be required to publish the complaints escalation procedure openly, for example on MitCo's website.

Information requirements

5.54 In addition to the information required under the reporting requirements relating to KPIs and any information requirements agreed with the OB in the MoU, the 800 MHz Licensees will be required to provide MitCo, the OB and Ofcom with information that those parties may reasonably require for the purposes of mitigating interference or making recommendations with respect to such steps being taken, or in Ofcom's case, for the purpose of carrying out any of its statutory functions.

5.55 The detailed information provision requirements to which the 800 MHz licensees will be subject are set out in the template licence schedules annexed to this Memorandum.

Platform change limit

5.56 Under the consumer support policy determined by Government, MitCo will need to provide platform changes where a consumer is eligible for a DTT receiver filter (or other measures to maintain DTT reception) but the filter or other measures have been ineffective in resolving interference.

5.57 Government has signalled its intent to set a limit on the number of platform changes that may be provided by MitCo. It proposes to make a decision on the limit once MitCo is operational and there is more certainty as to the number of households that are likely to require a platform change. The policy intention of the limit will be to encourage a bias towards restoring DTT reception rather than allowing the provision of platform changes to be MitCo's default response to interference complaints. We have included a licence condition in licences to ensure that the total number of platform changes provided does not exceed a certain number as may be notified to MitCo by Ofcom if Government decides to set a limit. To provide context on this, we note that our technical modelling estimated that approximately 15,000 primary DTT households might require a platform change if licensees choose not to use any mobile network-based mitigation.

5.58 The OB will keep the number of platform changes under review and advise Government in the light of practical experience once the consumer help scheme is operational. As such, 800 MHz Licensees will be required to ensure that MitCo reports to the OB on a monthly basis in relation to the number of platform changes that have been provided to consumers.

Closure of MitCo and managing interference after MitCo closes

5.59 In practice, this means that 800 MHz Licensees will be required to operate MitCo until the earlier of the following two dates:

- the end of 2018 (which is one year after the coverage obligation target date), or;
- 12 months after all 800 MHz Licensees have completed network roll-out.

5.60 If the latter of the two bullets above applies, licensees would all need to be able to demonstrate to the OB that their network roll-out was complete. The final decision on whether MitCo could cease operation would rest with Ofcom.

5.61 800 MHz Licensees would also be able to make a request to the OB that MitCo should close earlier if they can make a clear case for doing so. This request would have to have the unanimous support of 800 MHz Licensees, with the final decision resting with Ofcom.

5.62 In addition, we expect the following events to occur at MitCo closedown:

- Operation of the gainshare mechanism;
- Oversight Board disbanded; and
- 800 MHz Licensees' ownership of MitCo ceases.

5.63 Following MitCo closure, 800 MHz Licensees will continue to have an obligation to ensure that undue interference is not caused to reception of DTT services as part of the standard terms of their licences.

Section 6

Spectrum packaging and Reserve Prices

Introduction

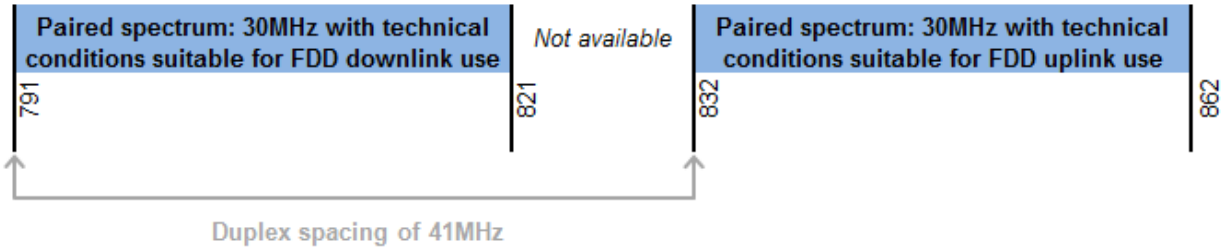
6.1 This section sets out the spectrum lots that will be available in the Award Process and the Reserve Price (as defined in the Regulations) for each lot.

Packaging for the 800 MHz band

Available spectrum and band plan

6.2 There is 2x30 MHz of spectrum available in the 800 MHz band, as shown in Figure 6.1. The band plan set out there is consistent with the 800 MHz Decision and with relevant equipment standards. The centre gap from 821 to 832 MHz is not being awarded in this Award Process.

Figure 6.1: band plan for the 800 MHz band

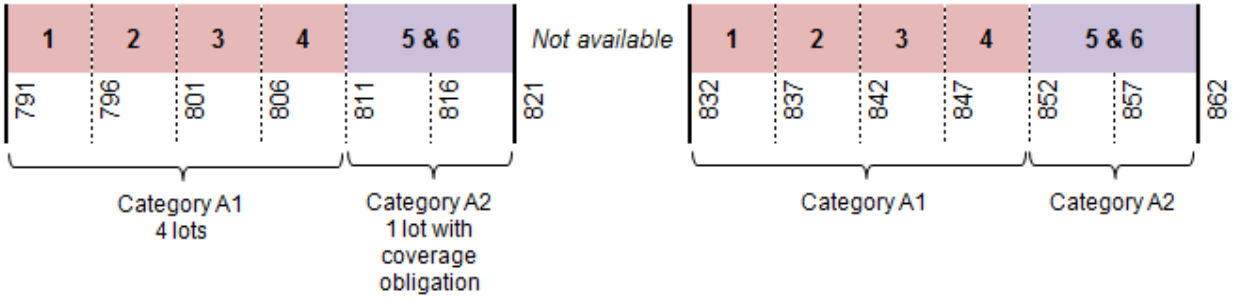


6.3 The 800 MHz Decision refers to assigned block sizes of multiples of 2x5 MHz and we are making the following lots available in the 800 MHz band (as shown in Figure 6.2):

- four generic lots of 2x5 MHz without a coverage obligation in respect of blocks 1 to 4 (791-811 MHz paired with 832-852 MHz).
- a specific 2x10 MHz lot to which the coverage obligation described in paragraph 4.32 attaches in respect of blocks 5 and 6 (811-821 MHz paired with 852-862 MHz).

6.4 Bidders will be required to make bids for contiguous blocks in the band. Therefore, for example, a bid for three A1 lots would be for either blocks 1, 2 and 3 or blocks 2, 3 and 4, and a bid for one A1 lot and the A2 lot would be for blocks 4, 5 and 6.

Figure 6.2: Band plan for the 800 MHz band with lot categories

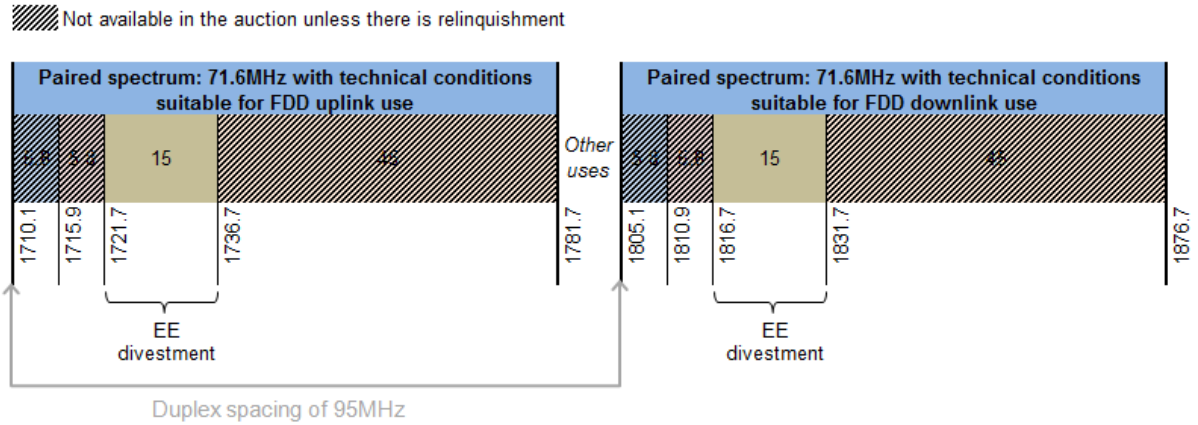


The 1800 MHz lot

6.5 Consistent with the Commitments, the 1800 MHz spectrum that EE is required to divest may be available in the Award Process. This depends on whether EE concludes a private sale of the rights to this spectrum, including approval from the European Commission and Ofcom, within the timeframe specified in the undertakings and ahead of the Award Process.

6.6 If this 1800 MHz spectrum is available in the Award Process, it will be available as a single lot in a distinct category and attached to specific frequencies at 1721.7-1736.7 MHz paired with 1816.7-1831.7 MHz, as illustrated in Figure 6.3.

Figure 6.3: the 1800 MHz lot and the 1800 MHz band



6.7 In the event that this spectrum is available in the Award Process, any party considering bidding for it should be aware that it will also need to be able to satisfy the test in the Commitments in order to be approved as a purchaser by the European Commission and Ofcom. The test is that the party must:

a) be independent of and unaffiliated to the Parties (as defined in the Commitments);

b) have the financial resources, proven expertise and incentive to use the spectrum as a viable and active competitive force in competition with the Parties (as defined in the Commitments) and other competitors; and

c) neither be likely to create, in the light of the information available to the European Commission, *prima facie* competition concerns nor give rise to a risk that the implementation of the Commitments will be delayed, and must, in particular,

reasonably be expected to obtain all necessary approvals from the relevant regulatory authorities for the acquisition of the spectrum.

6.8 Ofcom's decision to qualify any person as a bidder in the Auction in accordance with the Regulations cannot be taken as deemed approval for the purposes of the Commitments, or as an indication that such approval will be given. If a Licensee awarded this spectrum in the 1800 MHz band during the Award Process is not approved for the purpose of the Commitments, Ofcom intends to revoke the relevant Licence (or vary the Licence to remove any rights in relation to the spectrum in the 1800 MHz band).

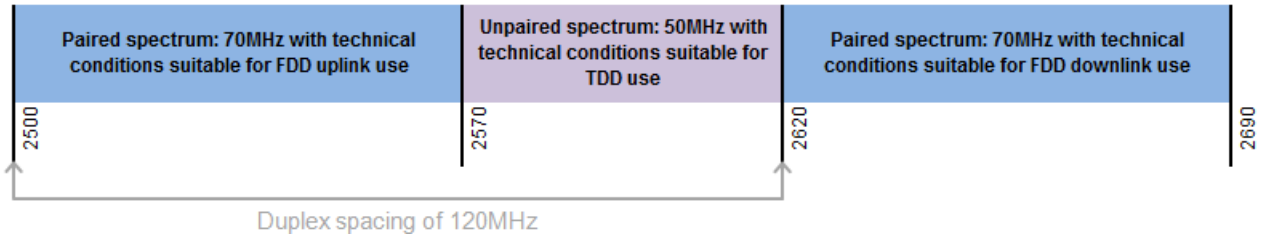
6.9 Parties should also be aware that the Commitments require EE to clear this spectrum in the 1800 MHz band, and surrender its licences to Ofcom by no later than 30 September 2013 (in relation to the frequencies 1721.7-1731.7 MHz and 1816.7-1826.7 MHz) and 30 September 2015 (in relation to the frequencies 1731.7-1736.7 MHz and 1826.7-1831.7 MHz). As a result, any Licence awarded by Ofcom in this band will only permit use of the relevant frequencies from after these dates.

Packaging for the 2.6 GHz band

Available spectrum and band plan

6.10 There are 190 MHz available in the 2.6 GHz band, with potential for both paired and unpaired use. We are using a fixed band plan that is consistent with the default configuration envisaged in the 2.6 GHz Decision, and consistent with relevant technical standards for this band. This involves 2x70 MHz of paired spectrum with a 120 MHz duplex spacing and 50 MHz of unpaired spectrum (including restricted blocks to manage the risk of interference between paired and unpaired use). Figure 6.4 illustrates the band plan.

Figure 6.4: band plan for the 2.6 GHz band



6.11 Two types of use are possible in the paired spectrum: individual use at standard powers and concurrent use at low powers.

Lot specification in the three categories

6.12 The paired spectrum will be packaged in:

a) 10, 12 or 14 generic lots of 2x5 MHz for individual use at standard powers – category C;

b) up to 10 lots for the same 2x10 MHz for concurrent use at low powers – category D1; and

c) up to 10 lots for the same 2x20 MHz for concurrent use at low powers – category D2.

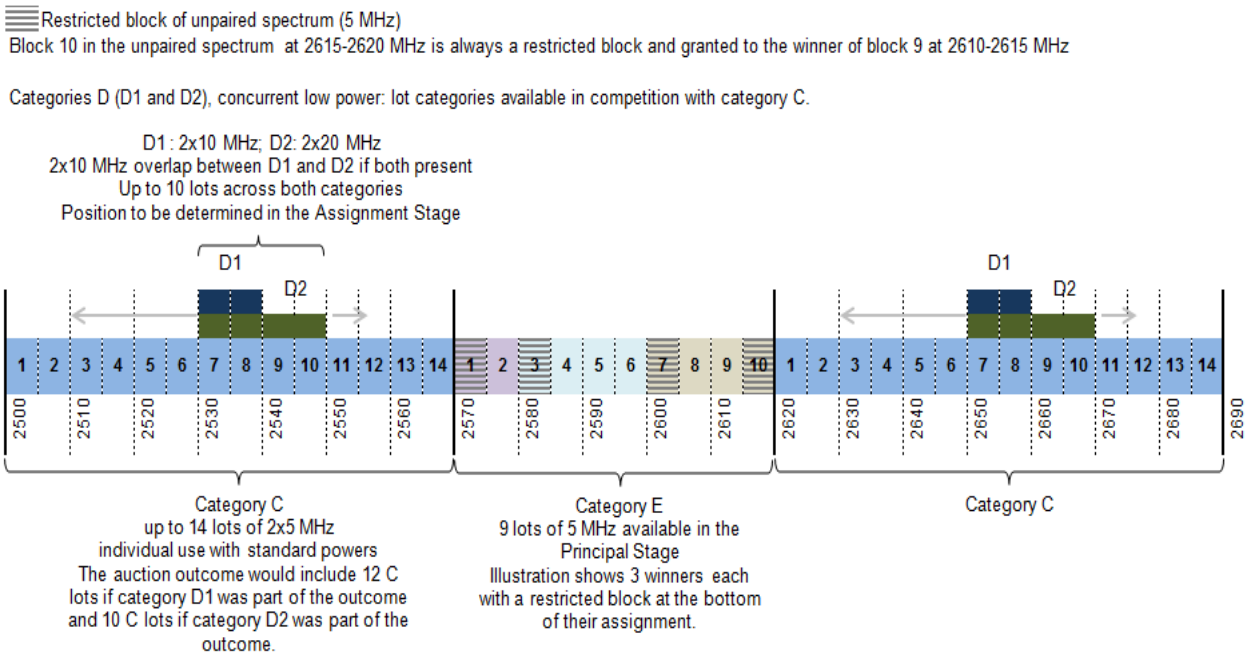
6.13 The number of lots in categories C, D1 and D2 that will be included in the Award Process outcome will depend on competition between these categories as expressed through the bids. If both D1 and D2 are included, they will overlap over 2x10 MHz. There can only be up to 10 lots across both categories D1 and D2.

6.14 The unpaired spectrum will be packaged in 9 generic lots of 5 MHz for individual use. Block 10 (2615-2620 MHz) will be a restricted block. Each assignment to a particular bidder will need to have a restricted block as its lowest lot. Therefore block 1 (2570-2575 MHz) will be a restricted block.

6.15 Figure 6.5 below illustrates the lot categories and organisation. For the purpose of the diagram below, we use an illustration in which there are three winners of unpaired spectrum; as a result, blocks 1, 3, 7 and 10 are restricted blocks. The illustration also includes D1 and D2 lots, which may or may not be included in the Award Process outcome.

6.16 The use of restricted block frequencies will be subject to the coordination procedures set out in the notice at Annex 4 to this Memorandum.

Figure 6.5: Proposed lots categories and band plan at 2.6 GHz (illustration with three winners of unpaired spectrum showing restricted blocks)



Reserve prices

6.17 The Reserve Prices, used as lot prices in the first round of the Auction and for the purpose of winner price determination in the Principal Stage (as defined in the Regulations) will be as follows.

Table 6.1 : Reserve Prices for the available lot categories

Lot category		Lot size	Reserve Price per lot (in £ millions)
800 MHz – generic	A1	2x5 MHz	225
800 MHz – coverage obligation	A2	2x10 MHz	250

1800 MHz (if included in the Auction)	B	2x15 MHz	225
2.6 GHz paired – individual use	C	2x5 MHz	15
2.6 GHz paired – concurrent low power use over 2x10 MHz	D1	2x10 MHz	3 per lot 30 across all lots awarded
2.6 GHz paired – concurrent low power use over 2x20 MHz	D2	2x20 MHz	6 per lot 60 across all lots awarded
2.6 GHz unpaired	E	5 MHz	0.1

Section 7

The Award Process

Introduction

7.1 The Award Process will be conducted in accordance with the Regulations, which set out the Award Process in detail. We published a Notice of our proposal to make regulations in connection with this award on 24 July 2012. The Notice provides an explanation of the proposed Regulations, and attaches a draft of the proposed Regulations. We have asked for comments on our proposal by 11 September 2012. We will have to consider all representations made in response to the Notice and, if necessary, change the content of the proposed Regulations. The Regulations as enacted may, therefore, differ from the draft attached to the Notice. The final form of the Regulations will be placed on the Ofcom website once they are made and they will be published by Her Majesty's Stationery Office and made available at www.legislation.gov.uk.

7.2 Anyone making or considering making an application should read and understand the rules of the Award Process as set out in the Regulations. The information in this section should be read in conjunction with the Regulations and the Notice. In particular, a number of the defined terms used in this section are explained in the Regulations and the Notice. If there is any discrepancy between this Information Memorandum and the Regulations, the Regulations are definitive and will prevail.

7.3 The purpose of this section is to provide some additional detail about the Award Process that will not be set out in the Regulations, particularly in relation to timing, the Electronic Auction System and certain other practical matters. Ofcom expects to publish further guidance about these matters when the Regulations are made and also during the Award Process itself.

Summary of Award Process

7.4 In summary, the Award Process comprises:

- a Pre-Application Stage under which Ofcom determines whether the 1800 MHz lot is available to be included in the Award Process;
- an Application Stage during which applications for licences will be made to Ofcom in accordance with the procedures described in the Regulations;
- a Qualification Stage during which Ofcom will determine whether applicants are qualified to bid in the Award Process;
- a two-stage Auction consisting of:
    - a Principal Stage with an Opt-In Round, one or more Primary Bid Rounds and a Supplementary Bids Round during which Bidders make bids for quantities of spectrum in various bands;
    - an Assignment Stage during which Winning Bidders will be able to bid for particular frequency ranges, or will be assigned particular

frequency ranges, within the frequency bands in which they have won spectrum in the Principal Stage; and

- a Grant Stage during which Ofcom will grant Licences to the Winning Bidder or Bidders for the frequencies assigned to them.

Anticipated Timings

7.5 The Regulations do not impose a timetable for the Award Process, but in this section Ofcom provides some guidance as to the time periods that it currently expects to apply to the various stages of the Award Process.

Start of the Award Process

7.6 The Award Process may only begin after the Regulations have come into force. The Regulations will state the date when they will come into force, which is likely to be 21 days after the date the Regulations are made.

7.7 Ofcom will determine whether the 1800 MHz lot is available to be included in the Award Process at least one week before the deadline for applications.

7.8 Ofcom will publish notice of the deadline for applications on the Ofcom website and there will be at least one week between the publication of the notice and the deadline for applications.

Questions and Answers before the deadline for applications

7.9 Any party interested in participating in the Award Process may submit questions in writing to Ofcom in relation to any aspect of the Award Process. Questions should be submitted at least five Business Days before the deadline for applications and Ofcom will aim to respond to all questions at least two Business Days before the deadline for applications. Questions should be sent by email to Combined.Award@ofcom.org.uk.

7.10 Ofcom's normal manner of responding to a question will be to respond by email to the person who asked the question. Ofcom will then consider whether to publish a copy of the question and of any response, in whole or in part, on the Ofcom website. However, in doing so, Ofcom will not normally identify the person who has asked the question without their consent. Any person not wishing any part of its question to be published, should clearly mark the relevant part(s) "Confidential" and Ofcom will take this into account in deciding whether and what to publish.

Application Stage

7.11 Ofcom will publish on the spectrum awards section of the Ofcom website[53] the details of the application procedures, including the day and time for delivery of Application Forms as well as the deadline for and guidance on the payment arrangements for the Initial Deposit.

7.12 In exceptional circumstances, Ofcom may be required to change the day, time or place for delivery of Application Forms or the payment of the Initial Deposit. Ofcom will take reasonable steps to inform interested parties of a change.

[53] http://stakeholders.ofcom.org.uk/spectrum/spectrum-awards/

Qualification Stage

7.13 Ofcom expects to notify each Applicant of the names and Associates of each other Applicant within two Business Days after the Application Day. This notification will also set a deadline by when Applicants must notify Ofcom whether or not any members of their Applicant Group are also Associates of another Applicant. In such cases, Applicants must also notify the other Applicant(s) concerned. Ofcom expects that Applicants will have two Business Days to complete this exercise.

7.14 In parallel with this exercise, Ofcom will also consider whether any members of one Bidder Group are also members of another Bidder Group.

7.15 Ofcom expects that Applicants will have five Business Days to resolve any common memberships.

7.16 In determining whether Applicants are qualified to bid in the Award Process Ofcom will take into account whether the Applicant or any member of its Applicant Group is receiving or attempting to receive services in relation to the Award process from anyone who has provided or is providing services to Ofcom in relation to the Award Process. For these purposes the advisers to Ofcom in connection with certain aspects of the Award Process are DotEcon Ltd, Cramton Associates LLC, Smith Institute, Real Wireless Ltd and Reynolds Porter Chamberlain LLP.

7.17 Ofcom expects that it will record the details of the Bidder Groups of each Applicant Group (for the purposes of determining which Applicants have qualified) as soon as reasonably practicable after expiry of the period for resolving any common memberships.

7.18 Ofcom expects to determine which Applicants have qualified to bid in the Award Process within approximately twelve Business Days after recording details of the Bidder Groups.

Preparations for the Principal Stage

7.19 Ofcom anticipates that following the Last Day for Withdrawal and before the start of the Opt in Round, it will:

a) send each Bidder a user manual for the Electronic Auction System;

b) notify each Bidder of passwords and deliver to each Bidder digital certificates required to access and use the Electronic Auction System and verify its identity;

c) notify each Bidder of the Bidder training arrangements (which will likely take place over two Business Days starting one Business Day after the information referred to in a) and b) has been provided);

d) notify each Bidder of the deadline by when and the bank account into which Bidders may pay their additional deposits;

e) notify each Bidder of the date and time on that date by which Ofcom will notify it of the Opt-in Round (this is likely to be two Business Days after the deadline for receipt of additional deposits); and

f) notify each Bidder of passwords required to verify that Bidder's identity where Ofcom has agreed that the Bidder may submit its bids by means of an Alternative Method to the Electronic Auction System.

Opt-in Round

7.20 Ofcom will give each eligible Bidder at least fifteen minutes' prior notice before the start of the Opt-in Round, by making an announcement via the Electronic Auction System. The duration of the Opt-in Round will be decided by Ofcom in its sole discretion although Ofcom does not anticipate it will be less than fifteen minutes or longer than sixty minutes in duration.

7.21 Ofcom will only schedule the Opt-in Round to take place between 10am and 5pm on a Business Day. Ofcom will give further guidance on the scheduling of the Opt-in Round during the Award Process, probably after the Last Day for Withdrawal.

7.22 After the Opt-in Round, Ofcom may publish on its website the number of Bidders that submitted valid Opt-in Bids.

Primary Bid Rounds

7.23 Ofcom will give each Bidder at least fifteen minutes' prior notice before the start of each Primary Bid Round by making an announcement via the Electronic Auction System. The duration of each Primary Bid Round will be decided by Ofcom in its sole discretion although Ofcom does not anticipate holding Primary Bid Rounds of less than fifteen minutes or longer than sixty minutes in duration.

7.24 Ofcom will only schedule Primary Bid Rounds to take place between 10am and 5pm on Business Days. There is no limit on the number of Primary Bid Rounds that may be held on a Business Day. Ofcom may decide not to hold any Primary Bid Rounds on a Business Day. It will give further guidance on the scheduling of rounds before the start of the Primary Bid Rounds.

7.25 Ofcom may publish on its website the total number of lots of particular Types that were included in valid Primary Bids submitted in Primary Bid Rounds which have completed.

Supplementary Bids Round

7.26 There will be at least one clear Business Day between the conclusion of the final Primary Bid Round and the start of the Supplementary Bids Round. Ofcom anticipates that the Supplementary Bids Round will take place between 10am and 5pm on a single Business Day and last for at least two hours but no more than seven hours.

Notification of the outcome of Principal Stage

7.27 Following the conclusion of the Supplementary Bids Round, Ofcom will determine the outcome of the Principal Stage in accordance with the Regulations. Ofcom anticipates that Bidders will be notified of the outcome no earlier than one clear Business Day following the end of the Supplementary Bids Round.

Assignment Stage

7.28 There will be at least one clear Business Day between the conclusion of the Principal Stage and the start of the Assignment Stage. Ofcom anticipates that the Assignment Stage will take place between 10am and 5pm on a single Business Day and last for at least two hours but no more than seven hours.

Granting the Licences

7.29 Following the conclusion of the Assignment Stage, Ofcom will determine the outcome of the Assignment Stage in accordance with the Regulations. It anticipates that Bidders will be notified of the outcome no earlier than one clear Business Day following the end of the Assignment Stage. Each Winning Bidder whose deposit is less than its Licence Fee will be required to increase its deposit (less any sum forfeited) to the level of its Licence Fee. Ofcom expects the deadline for this payment to be 23.59 on the Business Day following the day on which Ofcom gives the Bidder the relevant notification. It expects to grant Licences to Bidders that win Lots no earlier than one Business Day following the deadline for payment.

Submission of bids in exceptional circumstances

7.30 Where a Bidder is unable to submit a bid using the Electronic Auction System (see below) because of technical failure (or an event or circumstance with similar effect on that Bidder's ability to use the Electronic Auction System), it may seek Ofcom's permission to submit the bid using an alternative method in respect of either a specific round, all rounds to be held on a Business Day or for a specified period of time. The Bidder may seek the permission before the start of a round, during a round or during an extension to a round. If Ofcom gives it permission, the Bidder must submit its bid to Ofcom using the prescribed alternative method and any Bid submitted by that Bidder via the Electronic Auction System after Ofcom has granted permission to use the prescribed alternative method will not be accepted by Ofcom unless Ofcom agrees otherwise with the Bidder. In these circumstances, bids using the prescribed alternative method must be received by Ofcom by the date and time specified, subject to the rules on extensions described in the Regulations.

7.31 Bids submitted using an alternative method must comply with any requirements relating to the authentication of communications made by means of the prescribed alternative method that are notified to that Bidder by Ofcom.

7.32 Ofcom anticipates that alternative methods may include fax or email. Further guidance on this will be provided before the start of the Principal Stage.

Electronic Bidding System

7.33 Both the Principal Stage and the Assignment Stage will be conducted using the Electronic Auction System. Bidders will be able to access the system over the public Internet using a standard web-browser. The minimum requirements in terms of hardware and software will be described in a user manual that will be distributed to Bidders prior to the start of the Principal Stage. However, these requirements will not be onerous – a typical PC running Windows and using Internet Explorer or Firefox or an Apple Mac using Safari or Firefox should usually be sufficient. Java (Version 6.22 or newer) will need to be installed on the Bidder's computer to access the Electronic Auction System (if not already available, this can be downloaded from www.java.com and installed).

7.34 Bidders will need to have a reliable Internet connection (512Kbit/s download speed or better, so a typical ADSL or E1/T1 connection will suffice). Ofcom recommends that Bidders have at least a backup computer and backup Internet connection in place for the duration of the Auction.

7.35 Bidders will each have their own electronic security details to connect to the Electronic Auction System and will need to ensure that these details are not disclosed to third parties. In the event of any actual or suspected breach of security, Bidders should contact Ofcom at the earliest opportunity.

7.36 The Electronic Auction System only allows a Bidder to be logged in from one computer at any one time.

7.37 The Electronic Auction System allows Bidders to enter bids and to observe the progress of the Auction. It provides a display of key aspects of the Auction state, such as the number of completed Primary Bid Rounds, whether a round is currently running and a countdown timer for submitting decisions when deadlines are in force. It also displays a clock synchronised with the Auction server to aid Bidders in submitting bids. However, Bidders should note that deadlines apply according to the time that bids are received at the server, not the time that they are sent from the Bidder's computer. Therefore, it is prudent for bids to be submitted in good time prior to the end of each round to allow for network delays. Bids are not processed by the Electronic Auction System and results are not released until after the end of each round, so there is no strategic advantage to Bidders from delaying submission of their bids.

7.38 Submitting a bid into the Electronic Auction System involves a two-step checking and confirmation process (regardless of whether the bid is an Opt-in Bid, a Primary Bid, a Supplementary Bid or an Assignment Stage Bid). Bidders will first need to enter their bid (or bids) for checking by the Electronic Auction System. The Electronic Auction System will check that the bid (or bids) is consistent with the Regulations. If not, the Bidder will be given an explanation of the problem and be returned to the relevant screen to allow further editing of the bid (or bids). If the bid (or bids) is consistent with the Regulations, the Electronic Auction System will return a summary of the bid (or bids), which can then be submitted. Only bids that have been submitted (and comply with the relevant provisions of the Regulations) will be considered to be valid bids. If a Bidder checks a bid but then fails to submit it, no bid will have been made.

7.39 Throughout the Primary Bid Rounds, Bidders will be able to use the Electronic Auction System to store and update a list of Supplementary Bids on a provisional basis. This list of provisional Supplementary Bids can then be edited, checked and submitted during the Supplementary Bids Round. The facility to check and submit Supplementary Bids will be disabled until the start of the Supplementary Bids Round.

7.40 The Electronic Auction System will provide summaries of each Bidder's own bids and also a history of Round Prices and aggregate demand. Downloadable files of a Bidder's own bids and of the Auction history will be provided for transferring data to other software applications. These will be available in comma separated value (.CSV) and tab delimited (.TXT) formats. Either format can be easily read by programs such as Microsoft Excel.

7.41 The Electronic Auction System provides a one-way messaging system that allows Ofcom to send notices to Bidders. Ofcom envisages this being the primary means of communicating with Bidders about Round schedules, deposit increase deadlines and other aspects of the Award Process. If Bidders need to contact Ofcom, they will need

to do so in accordance with the Regulations. Ofcom will provide specific contact details before the start of the Principal Stage.

Ofcom events related to the Award Process

7.42 Ofcom is planning to hold a number of events that will allow interested parties to familiarise themselves with the Auction design and procedures and with the Electronic Auction System. These will include a seminar explaining the relevant rules and mock auctions. Also as indicated above at paragraph 7.19, after the Last Date for Withdrawal, Ofcom will undertake training for Bidders on the use of the Electronic Auction System. These events will be arranged to assist potential Applicants and Bidders in making decisions as to whether to participate in the Award Process and in making preparations for participation in the Auction. Ofcom will publish further details of such events on the spectrum awards section of the Ofcom website: http://stakeholders.ofcom.org.uk/spectrum/spectrum-awards/.

Payment of Deposits and Ofcom's Bank Account

7.43 Any sum payable by an Applicant or Bidder to Ofcom must be made by a same day electronic transfer into the bank account specified by Ofcom, with accompanying information which identifies that Applicant or Bidder. Ofcom will publish on the spectrum awards section of the Ofcom website (http://stakeholders.ofcom.org.uk/spectrum/spectrum-awards/) details of the bank account into which initial deposits must be paid.

7.44 The Regulations set out when Ofcom may or will require deposit payments. We expect that we will give Bidders at least one full Business Day to pay a deposit into Ofcom’s bank account.

Section 8

Associated issues

Ofcom's approach to the regulation of the radio spectrum

8.1 Ofcom licenses use of most of the civil radio spectrum in the UK, with the aim of securing the optimal use of spectrum and meeting Ofcom's other statutory duties. Ofcom also represents the UK internationally on spectrum matters. Ofcom administers spectrum use in the UK by licensing or by exemption from the requirement to hold a licence under section 8 of the WT Act. Ofcom's general approach to spectrum management has been set out in a number of documents Ofcom has published, including:

- the Spectrum Framework Review (SFR) consultation document published in November 2004 and Statement published in June 2005 [54];
- the Spectrum Trading consultation document published in November 2003 and the Trading Statement published in August 2004[55];and
- the Spectrum Liberalisation consultation document published in September 2004 and Statement published in January 2005.[56]

8.2 The approach is also summarised in the SFR Implementation Plan (SFR:IP) consultation document, and in the SFR:IP Interim Statement of 28 July 2005[57] .

8.3 The Award Process outlined in this Memorandum forms part of a wider programme of awards which was proposed in the SFR:IP. Ofcom's general approach to the awards in this programme is outlined in the SFR:IP and the Interim Statement on the SFR:IP published on 28 July 2005 . The Ofcom spectrum awards website[58] contains information and updates on the programme of awards.

The Government Direction

8.4 On 20 December 2010, the Secretary of State made a Direction pursuant to section 5 of the WT Act (the Direction)[59]. The Direction requires Ofcom to do a number of things, in particular:

- Article 8 of the Direction requires Ofcom as soon as reasonably practicable to assess likely future competition in markets for the provision of mobile electronic communications services.
- Article 9 of the Direction requires Ofcom, as soon as reasonably practicable after concluding the competition assessment referred to above, to exercise its power to make regulations under section 14 of the WT Act to provide for an

[54] Available at http://www.ofcom.org.uk/consult/condocs/sfr/
[55] Available at http://www.ofcom.org.uk/consult/condocs/spec_trad/
[56] Available at http://stakeholders.ofcom.org.uk/consultations/liberalisation2/
[57] Available at http://www.ofcom.org.uk/consult/condocs/sfrip/
[58] Available at http://www.ofcom.org.uk/radiocomms/spectrumawards/
[59] The Wireless Telegraphy Act 2006 (Directions to OFCOM) Order 2012 http://www.legislation.gov.uk/uksi/2010/3024/contents/made

auction of licences to take place for use of frequencies in the 800 MHz and 2.6 GHz bands and any other frequencies as Ofcom thinks fit.

Annual licence fees for mobile spectrum licences

8.5 After completion of the Award Process, Ofcom is required by Article 6 of the Direction to revise the annual licence fees for the licences for use of the 900 MHz and 1800 MHz bands so that they reflect the full market value of the frequencies in those bands, having particular regard to the sums bid for Licences in the Award Process. We will consult specifically on these annual licence fees following the Award Process.

Licensing position in other spectrum bands that are used for mobile communications

8.6 The UK has three bands allocated for electronic communications services:

- 880 to 915 MHz paired with 925 to 960 MHz (the 900 MHz band);
- 1710 to 1785 MHz paired with 1805 to 1880 MHz (the 1800 MHz band); and
- 1890 to 1980 MHz paired with 2110 to 2170 MHz (the 2.1 GHz band).

The 900 MHz and 1800 MHz bands are currently licensed for both 2G and 3G use and the 2.1 GHz band is licensed only for 3G services.

8.7 Three mobile network operators hold licences for the 900 MHz and 1800 MHz bands – EE, Telefónica and Vodafone. EE has spectrum only in the 1800 MHz band (2 x 60 MHz) whereas Telefónica and Vodafone have spectrum predominately in the 900 MHz band but also have an assignment each of 2 x 5.8 MHz in the 1800 MHz band. At the upper end of the paired 1800 MHz band, 2 x 3.3 MHz is held concurrently by 12 licensees for low power use.

8.8 The same three operators plus Hutchison 3G (H3G) hold licences for the 2.1 GHz band. All four operators have duplex FDD assignments. In addition EE, Telefónica and H3G have TDD assignments. Table 8.1 below shows the frequency assignments of each operator.

Table 8.1: Licensing position in the 900 MHz, 1800 MHz and 2.1 GHz bands

	Everything Everywhere (T-Mobile and Orange)	Telefónica	Vodafone	H3G	Total
900 MHz Paired	-	2x17.4	2x17.4	-	69.6
1800 MHz Paired	2x60	2x5.8	2x5.8	-	143.2
2.1 GHz Paired	2x20	2x10	2x15	2x15	120.0
2.1 GHz Unpaired	1x10	1x5	-	1x5	20.0
Total	**170**	**71.4**	**76.4**	**35**	**352.8**

1800 MHz divestment

8.9 In March 2010 the European Commission approved the merger between T-Mobile and Orange in the UK. One condition of the Commission's approval was that the

merged operator EE would divest 2x15 MHz of the spectrum it holds in the 1800 MHz band. This spectrum could be divested through a private sale to a single purchaser or unconditionally offered for sale as part of this award or another spectrum award (i.e. handed back to Ofcom for re-award).

Variations to 2G and 3G licences and regulations

8.10 The Direction also imposes certain obligations on Ofcom in relation to existing 2G and 3G licences. Ofcom is required to:

- amend the Spectrum Trading Regulations[60] to permit the transfer of the rights and obligations in 900 MHz, 1800 MHz and 2.1 GHz licences.
- vary 900 MHz and 1800 MHz licences:
  - to permit use for both 2G (GSM) and 3G (UMTS services)
  - to extend the revocation notice period to five years; and
- vary 2.1 GHz licences (subject to the consent of the licensees) to provide:
  - a new coverage obligation;
  - a change to the licence duration;
  - a revocation notice period of five years (such revocation not to be capable of taking effect before the period for which the licences were auctioned expires); and
  - for annual licence fees to be charged from the end of 2021 (when the period for which the licences were auctioned expires).

8.11 In anticipation of the Direction being made, on 28 October 2010 we published a Notice proposing to vary the existing 900 MHz and 1800 MHz licences to allow UMTS use. Having considered all the responses to the Notice we decided to vary the licences in line with the proposal in the Notice, subject to some minor changes to the drafting of the licences[61]. We published a statement on 6 January 2011[62].

8.12 We published a notice[63] (the trading notice) on 2 February 2011 setting out how we proposed to amend the Spectrum Trading Regulations to permit the transfer of the rights and obligations in 900 MHz, 1800 MHz and 2.1 GHz licences. We published a statement on 20 June 2011[64].

8.13 We also published on 2 February 2011[65] a consultation on how we propose to vary the 2.1 GHz licences as required by the Direction, subject to the consent of the licensees. We published a statement on 20 June 2011[66].

8.14 On 8 May 2012 we published a notice of a proposed variation of EE's 1800 MHz licences to allow use of LTE and WiMAX. We intend to publish a statement on this as soon as possible. Subject to market demand, we intend to carry out the authorisation process in relation to variation of the other 900 MHz and 1800 MHz licences by 31 December 2012 in accordance with Article 6(2) of Commission decision

[60] http://www.legislation.gov.uk/uksi/2004/3154/introduction/made
[61] http://stakeholders.ofcom.org.uk/consultations/900-1800mhz-wireless-telegraphy/
[62] http://stakeholders.ofcom.org.uk/binaries/consultations/900-1800mhz-wireless-telegraphy/statement/Statement.pdf
[63] http://stakeholders.ofcom.org.uk/consultations/trading-900-1800-2100/
[64] http://stakeholders.ofcom.org.uk/binaries/consultations/trading-900-1800-2100/statement/900-1800-2100-statement.pdf
[65] http://stakeholders.ofcom.org.uk/consultations/2100-MHz-Third-Generation-Mobile/
[66] http://stakeholders.ofcom.org.uk/binaries/consultations/2100-MHz-Third-Generation-Mobile/statement/statement.pdf

243/2012/EU[67]. We will consider variations of 2100 MHz licences when technical conditions have been agreed within Europe.

Other spectrum awards

8.15 Ofcom's programme of spectrum awards is subject to change from time to time, as are other aspects of spectrum policy and regulations. The latest information on Ofcom's programme of spectrum awards is given on the Ofcom spectrum awards website.[68] Information on specific bands which may be subject to a future award is summarised below.

600 MHz band (550-606 MHz)

8.16 This spectrum is being released by digital switchover and will be free of other uses by the end of 2012.[69] It is suitable for DTT use as there is a primary allocation for broadcasting use as across Europe[70], relevant equipment standards and an international treaty (Geneva 2006[71]) that co-ordinates this use. It would also be suitable for use by applications that can share with DTT services, including PMSE and white space devices (also see paragraphs 8.21 to 8.22 below). It is not currently standardised or harmonised for mobile broadband use in Europe. Ofcom's plans for its future release will be determined as part of our longer term strategy for UHF bands IV and V[72], in particular the 700 MHz band (see below).

700 MHz band

8.17 This spectrum is currently used to deliver DTT services in the UK. However, in the future, this spectrum may be made available for mobile services:

- In February 2012, the WRC-2 decided that the 700 MHz band would be allocated on a co-primary basis for broadcast and mobile broadband use. This new allocation will be effective following the next WRC in 2015 on completion of relevant technical studies, before becoming applicable to ITU Region 1, which includes Europe, Africa and parts of the Middle East.

- In March 2012 Ofcom published a consultation on securing long term benefits from UHF spectrum bands IV and V (470-862 MHz)[73]. This consultation closed on 7 June 2012. One outcome of that consultation will be to establish our longer term strategy on whether to enable the future release of the 700 MHz band for mobile services. We anticipate publishing our conclusions on that strategy by the end of 2012. Our view set out in that consultation is that it is unlikely that any clearance of the 700 MHz band to enable a harmonised and coordinated release for mobile broadband use could start before 2018 but that this date is subject to a high degree of uncertainty. The 700 MHz

[67] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:081:0007:0017:EN:PDF
[68] http://stakeholders.ofcom.org.uk/spectrum/spectrum-awards/
[69] http://stakeholders.ofcom.org.uk/binaries/consultations/600mhz_geographic/summary/600condoc.pdf (paragraph 1.1)
[70] See The European Common Allocation Table (ERC Report 25) http://www.erodocdb.dk/Docs/doc98/official/pdf/ERCREP025.PDF
[71] Geneva 2006: Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz (RRC-06) http://www.itu.int/pub/R-ACT-RRC.14-2006/en

[72] See http://stakeholders.ofcom.org.uk/binaries/consultations/uhf-strategy/summary/spectrum-condoc.pdf (section 6)

[73] http://stakeholders.ofcom.org.uk/consultations/uhf-strategy/

band occupies the frequency range 694 to 790 MHz but the exact range harmonised for mobile services in ITU Region 1 is expected to be determined through work under the auspices of the ITU ahead of the next WRC in 2015.

2010-2025 MHz

8.18 Ofcom published a statement in February 2011[74] noting some evidence of demand for mobile services in this band and indicating that a competitive award could be the most beneficial approach to its release. The details of the award will be the subject of a future consultation. A date for this consultation and the release of this band has not been set. In the meantime PMSE use has temporary access to the band with a rolling three-month notice period.

8.19 This band is identified for IMT within CEPT[75] and has been standardised[76] for TDD mobile broadband use in Europe. However, the future use and harmonisation of this band in Europe is currently being considered by the European Commission's Radio Spectrum Committee (RSC). To support this, the Commission is developing a draft mandate to CEPT to undertake studies on the harmonised technical conditions for this band in the EU.

872-876 MHz and 917-921 MHz

8.20 Ofcom consulted[77] on the potential use of this band in 2009 and published an update in 2010[78]. There are also ongoing CEPT studies on the potential use of this band for short range devices and GSM-R (the mobile standard for railway communication)[79]. This spectrum is not currently standardised[76] or harmonised[75] for mobile broadband use in Europe. At present Ofcom's work on the release of this spectrum is on hold.

White Space Devices: Implementing Geolocation

8.21 On 9 November 2010 we published a consultation document[80] titled 'Implementing Geolocation'. This related to the enabling of White Space Devices, in the white space (or interleaved) spectrum between 470 MHz and 790 MHz. This would allow interleaved spectrum to be available for innovative and new services, including rural broadband and urban Wi-Fi networks.

8.22 We subsequently published a statement[81] on 1 September 2011. This document summarises our approach to implementing the database approach to allow licence exempt wireless devices to access white space spectrum. Our next steps are to:

- Consult on and subsequently publish a Statutory Instrument exempting appropriate devices from the need for a licence.

[74] http://stakeholders.ofcom.org.uk/binaries/consultations/release_2010_2025/statement/statement.pdf
[75] See the European Common Allocation Table (ERC Report 25) http://www.erodocdb.dk/Docs/doc98/official/pdf/ERCREP025.PDF
[76] See ETSI Harmonised Standard EN 301 908-14 http://www.etsi.org/deliver/etsi_en/301900_301999/30190814/05.02.01_60/en_30190814v050201p.pdf
[77] http://stakeholders.ofcom.org.uk/binaries/consultations/872_876_mhz/summary/872_condoc.pdf
[78] http://stakeholders.ofcom.org.uk/consultations/872_876_mhz/update/
[79] The CEPT studies are based on ETSI proposals TR 102 649-2, TR 102 886, TR 103 055 and TR 103 056. They are described in document FM(11)166 Annex 17 accessible at http://www.cept.org/ecc/groups/ecc/wg-fm/client/meeting-documents
[80] http://stakeholders.ofcom.org.uk/binaries/consultations/geolocation/summary/geolocation.pdf
[81] http://stakeholders.ofcom.org.uk/binaries/consultations/geolocation/statement/statement.pdf

- Investigate arrangements, in co-operation with industry partners, to enable information about licensed services in the relevant spectrum to be made available to a database.

- Specify requirements to be met by geolocation database(s) and their providers that wish to be accredited by Ofcom and listed on our website.

Public sector spectrum

8.23 In October 2010, the Government announced its intention to embark on a programme to release 500 MHz of public sector spectrum below 5 GHz for mobile communication uses, including mobile broadband[82].

8.24 In March 2011, the Government published the document 'Enabling UK growth – Releasing public spectrum: Making 500 MHz of spectrum available by 2020'[83] This document laid out Government's initial views and invited comments in a call for evidence. MOD, as part of Government's plan, has published further information on its plans for sharing and releasing spectrum[84].

8.25 In December 2011 the Government published an update on progress[85] including a summary work plan to 2020.

The Government's broadband objectives

8.26 The Government's vision, in its broadband strategy document[86], is for the UK to have the best superfast broadband network in Europe by 2015. It is committed to ensuring virtually all homes will have access to a minimum level of service of 2Mbps - its universal service commitment. However, it believes that most solutions that could deliver this would in fact deliver far more to most people and so it has aligned both its superfast broadband and universal service objectives.

8.27 The Government sees a mix of technologies being needed to deliver superfast broadband throughout the UK. These are likely to be primarily fixed technologies, given the nature of superfast broadband, with fibre deeper into the network being the key technology. Broadband Delivery UK, in its report on the conclusions of its Theoretical Exercise[87], considered broadband access would be delivered cost effectively to between 90% and 95% of premises by fibre, 5%+ by high-speed fixed wireless access and about 1% by satellite.

Mobile Infrastructure Project

8.28 The Government is committed to ensuring that consumers and citizens throughout the UK have wide access to high quality mobile communications infrastructure. It believes that increasing mobile connectivity is essential to drive benefits for local economies not only to improve mobile phone coverage, but also by encouraging

[82] http://cdn.hm-treasury.gov.uk/sr2010_completereport.pdf
[83] http://www.culture.gov.uk/publications/7994.aspx
[84] http://www.mod.uk/DefenceInternet/AboutDefence/WhatWeDo/ScienceandTechnology/Spectrum/
[85] http://www.culture.gov.uk/publications/8690.aspx
[86] http://webarchive.nationalarchives.gov.uk/+/http://www.culture.gov.uk/images/publications/10-1320-britains-superfast-broadband-future.pdf
[87] http://www.culture.gov.uk/images/publications/10-1330-broadband-delivery-exercise-conclusions.pdf

business growth and extending access to online public services. As part of this commitment, it has launched a Mobile Infrastructure Project (MIP), which will provide funding of up to £150m to improve mobile coverage in areas where coverage is poor or non-existent, with the aim of extending mobile service coverage to 99% of the UK population.

8.29 Following the Government's initial announcement on MIP in the Autumn Statement in October 2011[88], the project's objectives have been refined as part of the 2012 Budget[89]. The Government is seeking to secure mobile voice services for up to 60,000 or so premises that currently do not receive any mobile service from any operator. It is also looking to improve mobile voice services along busy roads that currently have poor coverage. Ten such roads were announced by the Chancellor (see Table 8.2), including at least one road in each of England, Wales, Scotland and Northern Ireland:

Table 8.2: Roads targeted to benefit from the Mobile Infrastructure Project

Name of road	Nation	Start	End
A2	Northern Ireland	Derry	Newry
A29	Northern Ireland	Coleraine	Armagh
A591	England	Keswick	Sizergh
A169	England	Whitby	Norton
A57	England	Liverpool	Manchester
A470(T)	Wales	Llandudno	Cardiff
A82(T)	Scotland	Inverness	Glasgow
A360	England	Devizes	Salisbury
A143	England	Great Yarmouth	Haverhill
A352	England	Sherborne	Wareham

8.30 Through MIP, the Government intends to award a contract for the design (including radio and transmission planning), build, installation, and operation of sites in the areas identified as having poor coverage. The infrastructure to be built for the MIP is expected to a certain extent to be suitable for use for future developments - for example 4G. On that basis MIP sites may enable MNOs to extend their 4G coverage footprint if they wish (the sites are to be made available on an open access basis). DCMS is in discussions with EE, H3G, Telefónica and Vodafone to provide mobile voice services from all MIP sites.

8.31 The Government expects the additional coverage to be in place by 2015, with the benefits starting to be realised from 2013.

8.32 Further details on MIP are available at http://www.culture.gov.uk/what_we_do/telecommunications_and_online/8757.aspx

The Government's work examining rail coverage

8.33 In the 2012 Budget, the Government also announced its intention to consider whether direct intervention is required to improve mobile coverage for rail passengers.

[88] http://www.hm-treasury.gov.uk/press_112_11.htm
[89] http://cdn.hm-treasury.gov.uk/budget2012_complete.pdf - see page 41.

Ofcom's work on mobile coverage

Research report on causes and impact of not-spots

8.34 In November 2010, we published an update to our research on understanding mobile not-spots[90]. Stakeholders had frequently raised mobile not-spots as an area of concern, warranting further investigation, and in our annual plan for 2010/2011 we had identified it as one of our priority areas.

8.35 In our research we categorised five types of not-spot:

- Complete not-spots: where there is no voice or broadband coverage from 2G or 3G networks. These can be over wide geographic areas or localised within urban areas and rural areas.
- Mobile broadband not-spots: where there is no 3G coverage but there is 2G coverage.
- Partial not-spots: where coverage is provided by one or more but not all MNOs.
- Interrupted coverage on the move: where reception is interrupted while travelling by rail or road.
- Indoor coverage: where coverage is poor or non-existent within buildings.

8.36 We explored whether market developments might address any of these problems. It was clear that the market has been developing (and continues to do so in 2012) in a number of areas:

- continued 3G rollout supported by increased coverage obligations, improving mobile broadband coverage;
- mergers and commercial network sharing arrangements between operators likely to improve partial not-spots; and
- solutions such as femtocells to help improve indoor coverage.

8.37 From a coverage perspective, these are promising developments. However, we recognised in 2010 that the commercial scope to address complete not-spots over time was more limited, so we were likely to see voice not-spots persisting, particularly in rural areas. Interrupted coverage on the move was also likely to remain an issue for citizens and consumers, particularly on railways. The Government's MIP and 2012 Budget announcement on rail coverage are focused directly on these areas where the market may be slow or unlikely to improve coverage.

Research report on consumer coverage information

8.38 In August 2011, we published Mobile coverage information for consumers[91]. The aim of this work was to test the usefulness of coverage information that mobile operators provided for consumers. Our role was not to provide coverage information ourselves

[90] http://stakeholders.ofcom.org.uk/market-data-research/telecoms-research/mobile-not-spots/
[91] http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/not-spots/mobile-coverage/mobile-coverage-information.pdf

given the mobile network operators all provide freely available coverage information through their online coverage checkers[92].

8.39 We undertook a research programme to understand the different factors that determine the consumer experience of using a mobile - with a focus on voice issues.

- We asked consumers about how they use coverage information provided by mobile operators – and coverage checkers in particular.
- We undertook desk based research to review how operators present coverage information to consumers and to understand how comparable the information is.
- We commissioned research to measure mobile signal strength – using Devon as a case study of a rural region - aimed at testing whether the operator data underlying coverage checkers is accurate and comparable.
- We commissioned research to consider the effect of the performance of different handsets on the consumer experience of using a mobile - and whether there are any implications for the accuracy of operator coverage data.

8.40 On the basis of our research, we explained that: mobile operators freely provide coverage information to consumers (online and in-store); the underlying operator coverage data is reasonably accurate for outdoor predictions; and consumers find coverage checkers easy to use and helpful in making supplier comparisons.

8.41 We also updated our consumer guide Maximising Mobile Coverage in 2012 to set out more clearly our advice for consumers, especially those for whom good mobile coverage is important. This guide is available to view or download from our website[93].

Other areas of work

Infrastructure reporting

8.42 Under the Digital Economy Act 2010[94], Ofcom is required to submit a report to the Secretary of State every three years, describing the state of the electronic communications networks and services in the UK. The first Infrastructure Report, published in November 2011[95], included information on the coverage and capacity of fixed and mobile networks (2G and 3G). In future reports we intend to report on the coverage of LTE services and changes to the coverage of existing mobile networks.

8.43 As noted in paragraph 8.30, the infrastructure to be built for the MIP may be suitable for future developments such as 4G services. Using MIP sites may enable MNOs to extend their 4G coverage footprint to support the coverage obligation. We will report on the use of MIP sites for 4G services as part of our Infrastructure reporting duty.

[92] http://ask.ofcom.org.uk/help/telephone/mobilecoverage
[93] http://consumers.ofcom.org.uk/files/2010/11/maximising-coverage.pdf
[94] http://www.legislation.gov.uk/ukpga/2010/24/contents
[95] http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/bbspeeds2011/infrastructure-report.pdf

Communications Market report

8.44 We published our Communications Market report on 18 July 2012[96]. This comprised a suite of reports. Mobile coverage information relating to Wales, Scotland and Northern Ireland was included in the respective reports for these nations.

Coverage obligations

8.45 The Direction includes a new obligation for 3G licences as part of a package of changes to the licences. The obligation is to cover by mid-2013 90% of the UK population, with users having 90% probability of receiving a minimum downlink speed of 768kbps in a lightly loaded cell. Our consultation on making relevant changes to 3G licences closed on 17 March and we published a statement on 20 June 2011[97].

8.46 We noted that coverage obligations in spectrum licences had in the past been used as a mechanism to help ensure a minimum level of mobile service availability across the UK. We drew attention to the possibility of such obligations being considered in future spectrum awards and to our consulting on the award of 800 MHz, once the Government Direction was in force. A coverage obligation is included in one of the 800 MHz licences to be awarded in the Award Process; the obligation is set out in the draft schedule at Annex 2B to this Memorandum.

Further action on mobile not-spots

8.47 In Ofcom's 2011/12 and 2012/13 Annual Plans, we noted that mobile not-spots continue to be a significant problem for consumers and businesses, particularly those in rural and semi-rural areas where coverage may be more patchy and there may typically be less choice of provider. In addition to our work supporting the Government to deliver the MIP which is improving mobile coverage, we are considering what further measures are necessary to address mobile not-spots, based on the regulatory mechanisms we have available.

8.48 We will also, working alongside Government, continue to examine the scope to facilitate coverage on the rail network to determine how to improve coverage for UK consumers as they travel, an area where not-spots particularly affect business consumers. As part of this work, we will engage with stakeholders in the communications and rail sectors to explore ways to improve mobile coverage on the rail network.

Glasgow 2014 Commonwealth Games

8.49 The UK Government has guaranteed the allocation of the frequencies required for the organisation of the Glasgow 2014 Commonwealth Games (the 'Glasgow Games'). While neither the Government nor Ofcom wishes to fetter its discretion, at this stage neither expects to exercise its power, without the consent of the relevant licensees, to vary or revoke the licences being awarded under the Award Process for the purpose of meeting the UK's international obligations relating to the Glasgow Games.

[96] http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr12/
[97] http://stakeholders.ofcom.org.uk/binaries/consultations/2100-MHz-Third-Generation-Mobile/statement/statement.pdf

Cable TV systems' use of the 800 MHz band

8.50 Cable services, by definition, are not delivered by wireless but they can use frequencies up to and including frequencies in the 800 MHz band within the cabling and in set top boxes (STBs) and cable modems (i.e. customer premises equipment (CPE)). Interference into CPE may arise if a mobile handset operating in the top of the 800 MHz band (i.e. using frequencies 832 to 862 MHz) is used close to it.

8.51 During 2010 we worked with Virgin Media and technical consultants to understand the scale of the potential interference problem in the specific UK circumstances. We commissioned a series of practical tests on a Virgin Media cable network using independent consultants Cobham Technical Services (CTS). We published the results of their work on our website in December 2010[98]. The main conclusion we have drawn from the report by CTS is that the potential interference is manageable. We summarised the reasons for this in the March 2011 consultation (paragraph 4.26).

8.52 Given that any significant deployment of two-way mobile services in the 800 MHz band is unlikely to occur before mid-2013 in the UK, we believe there is time to manage this issue. Virgin Media, and other cable operators, could do this by a combination of careful management of their frequency plans, replacement (if necessary) of older equipment with more resilient new equipment and basic information to customers on how to avoid interference when using LTE UE.

8.53 The Government, in a letter published on 10 July 2012 [99] setting out its decisions on interference to reception from LTE services operating in the 800 MHz spectrum, said that there should be no support for interference issues that result from problems with cable TV equipment. It said the cable company should be able to resolve any problems for customers of cable TV who may suffer some interference if they are using an older box.

Ofcom Consultations

8.54 Details of Ofcom consultations, those that are currently open and those that are closed, can be found on our website at http://stakeholders.ofcom.org.uk/consultations/.

Competition from other services

8.55 Any party considering participating in the Award Process must make its own independent assessment of the competition that its services using the 800 MHz, 1800 MHz or 2.6 GHz bands will face from existing and future services, and the implications of this competition for the potential value of a Licence.

8.56 It should be noted that other authorisations of spectrum use may permit the provision of services that could compete with those that may be offered using the 800 MHz, 1800 MHz or 2.6 GHz bands. Ofcom is not, as a function of the Award Process, placing any limitation on its scope for authorising others to use spectrum to offer such services. Such authorisation may occur, for example, by way of the grant of new licences, decisions as to the variation of existing licences, or decisions as to exemptions from licensing. As set out in the SFR and elsewhere, Ofcom's general policy is to move towards authorising the use of spectrum on a technology and

[98] http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/projects/ddr/2010-0792_LTE_into_CATV.pdf
[99] http://www.culture.gov.uk/images/publications/letter-dcms-ofcom-10072012.pdf.

application neutral basis that provides much greater flexibility for the use of spectrum to respond to demand and to be economically efficient.

Non-operational licences

8.57 We currently issue two classes of short-term non-operational wireless telegraphy licences:

- non-operational temporary use – licensed for up to six months; and
- non-operational development – licensed for up to12 months.

8.58 These licences enable the use of spectrum on a non-commercial, non-permanent basis for activities such as the testing and development of wireless telegraphy (radio) equipment, scientific research and experimentation, and trials and demonstrations of radio apparatus in a range of different frequency bands. Such licences are issued following a coordination procedure to assess the risk of harmful interference to existing services, which may also involve Ofcom contacting existing licensees or other authorised users of the spectrum in order for Ofcom to assess the risk and take a decision. Licences issued are under the condition that the equipment must not cause harmful interference to any other authorised services and that no protection will be given from harmful interference received from other authorised services. There is no right of renewal at the end of the term of a non-operational licence. At the time of these awards, there may be a number of non-operational licences in force in the spectrum bands being awarded.

8.59 Interested parties should note that we may issue further non-operational licences in the spectrum bands being awarded following the completion of the Award Process.

Other non-commercial usage

8.60 Ofcom may from time to time receive requests from the Crown for frequency clearances at specified locations, which includes frequency requests from the Foreign and Commonwealth Office for short-term use by visiting diplomats and dignitaries. Ofcom may give advice or provide services which are appropriate for facilitating or managing the use of spectrum, but Ofcom does not authorise the Crown. Ofcom may also request co-ordination directly with the spectrum user. Should the Crown decide to use spectrum it is on the understanding that the assessment of and the responsibility arising from any interference caused to civil radio services rests with the Crown and not Ofcom. The Crown may request co-ordination directly with spectrum users.

R&TTE Directive

8.61 The R&TTE Directive requires manufacturers to make declarations that their radio and telecommunications terminal equipment conforms to the essential requirements of the Directive. All products within the scope of the Directive that are placed on the UK market must show "CE" marks. The European Commission's "Blue Guide" (Guide to the Implementation of Directives Based on the New Approach and Global Approach) lists other Directives that require CE marking of products and equipment. It is available from the Commission's website[100].

[100] http://ec.europa.eu/enterprise/newapproach/legislation/guide/index.htm

Sitefinder

8.62 Sitefinder[101] is the Government's public access database of base stations which was developed in co-operation with industry as a result of the recommendations of the Stewart Report[102].

8.63 Ofcom hosts the Sitefinder tool on behalf of Government, which can be searched for the location and details of mobile phone base station sites around locations in England, Scotland, Wales and Northern Ireland.

8.64 The data within Sitefinder is owned by the MNOs, who supply periodic updates on a voluntary basis. All holders of a Licence will be invited to provide the information specified in the Sitefinder database in relation to their networks, on a voluntary basis.

8.65 Because of ongoing legal proceedings arising from a request for disclosure of the Sitefinder dataset submitted to Ofcom in 2005 under the Environmental Information Regulations 2004, there is uncertainty whether Ofcom may have to disclose the dataset at some point. Consequently EE (T-Mobile since 2005. Orange since 2010) and Airwave (since 2010) have decided to suspend participation.

8.66 Following clarification of a fundamental legal principle by the European Court of Justice, the case is currently being re-considered by the First Tier Tribunal (Information Rights).

Electronic Communications Code

8.67 The Electronic Communications Code enables electronic communications network providers to construct electronic communications networks. The Electronic Communications Code enables these providers to construct infrastructure on public land (streets), to take rights over private land, either with the agreement with the landowner or applying to a County Court or the Sheriff in Scotland. It also conveys certain immunities from Town and Country Planning legislation in the form of Permitted Development. In addition to providers of electronic communications networks the Electronic Communications Code is also available to those who wish to construct conduits to be made available to network providers.

8.68 The Electronic Communications Code is granted to network providers by Ofcom by a direction made following a public consultation and consideration of the responses to that consultation. Further information on the Electronic Communications Code is available on the Ofcom website[103].

8.69 The Electronic Communications Code has effect in all cases subject to the conditions and restrictions set out in the Electronic Communications Code (Conditions and Restrictions) Regulations 2003[104] as amended by the Electronic Communications Code (Conditions and Restrictions) (Amendment) Regulations 2009[105].

[101] http://www.sitefinder.ofcom.org.uk/
[102] http://www.iegmp.org.uk/report/text.htm
[103] http://stakeholders.ofcom.org.uk/telecoms/policy/electronic-comm-code/
[104] http://www.legislation.gov.uk/uksi/2003/2553/contents/made
[105] http://www.legislation.gov.uk/uksi/2009/584/contents/made

8.70 On 19 July 2011, the Law Commission published the 'Eleventh Programme of Law Reform'[106]. This programme includes, amongst other things, a review of the Electronic Communications Code. The programme also includes the proposed timetable for production of a report of recommendations in respect of the Electronic Communications Code.

Other regulation of the provision of electronic communication services and networks

8.71 It is the responsibility of interested parties who are considering using the spectrum bands being awarded to provide electronic communication services or electronic communications networks to familiarise themselves with any relevant regulation. The same is also true of all other aspects of regulation such as broadcasting regulation and competition law, It should be noted that all aspects of regulation are subject to change from time to time, including without limitation the relevant legislative framework and the nature of regulation within any given legislative framework. In addition, decisions taken pursuant to existing regulation or decisions to establish or vary existing regulation may be subject to an appeal to the Competition Appeal Tribunal or (where relevant) the subject of judicial review proceedings and as a result of any decision, or subsequent appeal, the underlying regulation, provision or decision may need to be re-considered.

8.72 In general and by way of example, interested parties should note:

- that there are General Conditions of Entitlement with which they may need to comply as described in more detail below;
- a number of operators may be subject to conditions imposed as a result of a finding of SMP, which conditions may enable another operator to rely upon e.g. a right to obtain network access (which may be of a specified type) and other obligations, such as regulated prices.
- that if Licensees wish to purchase access and interconnection from operators of existing networks for services in markets where those operators do not have SMP, our expectation is that these services should be negotiated commercially.

General Conditions of Entitlement

8.73 All providers of Electronic Communications Networks (ECNs) and Electronic Communications Services (ECSs) in the UK are covered by the General Conditions of Entitlement. Out of 24 conditions, some apply to particular categories of ECN or ECS provider, mainly depending on whether they provide public services or networks and whether they provide publicly available telephone services or public telephone networks.

8.74 It is the responsibility of any undertaking involved in providing an ECN or ECS to identify which conditions apply to it and ensure that it complies with them. Further

[106] http://www.justice.gov.uk/lawcommission/docs/lc330_eleventh_programme.pdf

information relating to the General Conditions of Entitlement can be found on the Ofcom website[107].

8.75 It should be noted that from time to time we consult on changing the General Conditions of Entitlement and any such proposals can be found on the Ofcom website[108].

International frequency allocation and harmonisation

8.76 All aspects of international arrangements are subject to change from time to time. Licensees will be required to ensure that their use of spectrum is consistent with the UK's international obligations. Interested parties should note that we cannot offer any protection to a Licensee from spectrum users in neighbouring countries operating in accordance with international agreements.

European Regulatory Framework

8.77 Interested parties should note that the EU has important powers and responsibilities regarding spectrum management. At a general level, European law provides a regulatory framework for electronic communications, including provisions on the use of spectrum. In 2009 the European regulatory framework for networks and services was amended and as a result of changes provided for in the Better Regulation Directive[109], a number of amendments to key provisions of the relevant directives, including the Framework Directive and the Authorisation Directive[110], have been implemented in UK law.

European Spectrum Decisions

8.78 Under the Radio Spectrum Decision[111], the European Commission can adopt decisions governing spectrum use. This can be done in the interests of ensuring effective policy coordination and, where appropriate, harmonised conditions for spectrum use in the internal market. These decisions are binding on Member States and are adopted by the Commission with the support of a qualified majority of Member States, convened under the name of the Radio Spectrum Committee (RSC). Ofcom represents the UK at the RSC under direction by the Government.

8.79 In May 2010 the Commission, through the RSC, harmonised the technical conditions of the use of the 800 MHz band for terrestrial systems capable of providing electronic communications service in the EU.

8.80 The 800 MHz Decision was unusual in that it did not mandate Member States to harmonise the 800 MHz band, allowing them to decide individually whether, and at what point, they designate or make available the band for networks other than high-power broadcasting networks. However the 800 MHz Decision dictates that when a

[107] http://stakeholders.ofcom.org.uk/telecoms/ga-scheme/general-conditions/
[108] http://stakeholders.ofcom.org.uk/consultations/
[109] Directive 2009/140/EC
[110] Framework Directive (2002/21/EC) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0033:0033:EN:PDF and Authorisation Directive (2002/20/EC) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0021:0021:EN:PDF
[111] http://eur-lex.europa.eu/LexUriServ/site/en/oj/2002/l_108/l_10820020424en00010006.pdf.

Member State does designate or make available the 800 MHz band for networks other than high-power broadcasting, the Member State must do so on a non-exclusive basis, for terrestrial systems capable of providing electronic communications services and in compliance with the technical parameters in the 800 MHz Decision.

8.81 The timetable for the 800 MHz Decision however became mandatory with the adoption of the Radio Spectrum Policy Programme in March 2012. The Programme sets a deadline of 1 January 2013.

8.82 In June 2008 the Commission harmonised the use of the 2.6 GHz band for terrestrial systems capable of providing electronic communications services in the Community. The 2.6 GHz Decision required Member States to designate and make available, on a non-exclusive basis, the 2.6 GHz band in compliance with the technical parameters laid down in the 2.6 GHz Decision.

8.83 In recognition that the original deadline of December 2008 had challenged many Member States, the European Parliament and Council, through the Radio Spectrum Policy Programme required that Member States make the 2.6 GHz band available and, subject to market demand, carry out an authorisation process by 31 December 2012, without prejudice to the existing deployment of services and under conditions that allow consumers easy access to wireless broadband services.

8.84 Interested parties should note that in the event of a future Commission Decision covering these spectrum bands or any other spectrum band where changes are necessitated by EU legislation, we may be required to change the terms and conditions of the licences and these changes may impose restrictions on services and technologies.

Radio Spectrum Policy Programme

8.85 The Radio Spectrum Policy Programme (RSPP) was agreed by the European Council and Parliament in March 2012. The RSPP sets out the policy orientations and objectives for the strategic planning and harmonisation of the use of spectrum with the aim of enhancing the internal market for wireless electronic communications services and equipment as well as other EU policies requiring spectrum use.

8.86 The key elements of the RSPP include:

- ensuring the availability of spectrum to meet future wireless broadband demand. The RSPP requires that every effort is made to identify at least 1200MHz of spectrum suitable for wireless broadband by 2015;

- a spectrum inventory to review spectrum use and assess the efficiency of that use. The inventory will focus on spectrum bands from 400 MHz to 6 GHz and cover both commercial and public use of spectrum. It will aim to; indentify frequency bands in which the efficiency of existing use could be improved; frequency bands that could be suitable for re-allocation or spectrum sharing opportunities to support EU policies; and frequency bands that could be allocated or re-allocated in order to improve their efficient use, promote innovation and enhance competition in the internal market and explore new ways of spectrum sharing;

- proposals for an enhanced role for the EU in future international spectrum negotiations; and

- deadlines for the release of the 800 MHz and 2.6 GHz bands as discussed above.

Regulation of Investigatory Powers Act 2000 (RIPA)

8.87 The Regulation of Investigatory Powers (Maintenance of Interception Capability) Order 2002 (the Order) sets out the obligations which it appears to the Secretary of State reasonable to impose on service providers for the purpose of securing that it is and remains practicable for requirements to provide assistance in relation to interception warrants to be imposed and complied with. The relevant obligations are set out in Part II of the Schedule to the Order. These obligations apply to service providers who offer, provide, or propose to provide a public telecommunications service to more than 10,000 persons in any one or more parts of the UK, other than service providers who only provide a public telecommunications service in relation to the provision of banking, insurance, investment or other financial services.

8.88 For further information and guidance on RIPA and these obligations, please contact RIPA.Info@ofcom.org.uk in the first instance.

Tax

8.89 Any party considering participation in the Award Process must take its own advice on the tax consequences of being awarded a Licence.

8.90 Payments for WT Act licence fees are not subject to VAT. The question of whether VAT should be payable in the case of the 3G mobile telephone WT Act licences auctioned in 2000 was heard by the European Court of Justice, which delivered its judgement on the matter on 26 June 2007[112]. The Court held that in the case of these licences, the Government issued them in a regulatory capacity which was not an economic activity and consequently their issue was outside the scope of VAT.

8.91 The Court's judgement confirms the UK interpretation of VAT legislation, namely that where a WT Act licence is issued by a public authority pursuant to public law and in order to regulate the use of the radio frequencies, that activity is outside the scope of VAT.

[112] http://curia.europa.eu/jurisp/cgi-bin/form.pl?lang=en&Submit=Rechercher&alldocs=alldocs&docj=docj&docop=docop&docor=docor&docjo=docjo&numaff=C-284/04&datefs=&datefe=&nomusuel=&domaine=&mots=&resmax=100, and http://curia.europa.eu/jurisp/cgi-bin/form.pl?lang=en&Submit=Rechercher&alldocs=alldocs&docj=docj&docop=docop&docor=docor&docjo=docjo&numaff=C-369/04&datefs=&datefe=&nomusuel=&domaine=&mots=&resmax=100

Section 9

Application instructions

Application Procedure

9.1 The procedure for making an application for a Licence will be set out in the Regulations. As explained in section 7, Ofcom will announce details of the relevant time and date for an application to be made.

Contacts for enquiries

9.2 Any further enquiries relating to this Memorandum and the Award Process should be addressed in writing and sent by email directly to Ofcom at Combined.Award@ofcom.org.uk. These should be marked for the attention of: Robert Emson and also marked: “Spectrum Auction Question – Award of 800 MHz and 2.6 GHz”.

Disclosure of further information

9.3 Following issue of this Memorandum, Ofcom has the discretion to publish further information and to publish questions and the answers provided. Ofcom may, however, exercise its discretion not to publish a particular question and answer, in whole or in part. Ofcom also reserves the right not to respond to such a question, and to publish relevant guidance arising from an answer to such a question. The identity of questioners will not be published without their permission