The Spectrum Plan for the London 2012 Games: An Update

Statement
Update

Publication date: 18 October 2010

Contents

Section 1

Executive Summary

1.1 On 19 October 2009 we published our Statement[1] setting out the spectrum plan for wireless communications at the London 2012 Games. In the Statement we recognised that some details of the spectrum plan must continue to evolve over time as new information on demand and supply improved our understanding of the requirements for each of the London 2012 Games venues. We said that we expected to publish an update to the spectrum plan, including venue-specific plans, in the second half of 2010.

1.2 This Update to the Statement sets out the evolution of the plan so far. The spectrum plan will continue to evolve and further updates will be published when needed. We expect the final version of the plan will be published early in 2012.

1.3 This Update also summarises the responses to our consultation[2] on reserving the 2500–2690 MHz band (the "2.6 GHz band") for the London 2012 Games, which closed on 17 September 2010. We will publish a statement on this later this year.

Spectrum supply

1.4 Most of the spectrum bands identified in the Statement continue to be available; and access to some additional bands has been secured or is being progressed. This Update provides further detailed information on these and identifies any changes. We believe that the spectrum plan continues to deliver the spectrum that will be required to meet the Government's guarantees.

Potential spectrum bands

1.5 **2.6 GHz band.** In our Statement, we judged that this band would be awarded and brought into use for new purposes within the timescale of the London 2012 Games; and that the opportunity cost of reserving it for the Games would therefore be high. Since then the timing of the award has changed and we consulted on the proposal to reserve the band for wireless camera use at the Games[3]. Most responses favoured the proposal, but significant points were raised and at this stage we do not have sufficient information to decide to reserve the 2.6 GHz band for Games. We will undertake a further assessment of the opportunity cost of doing so; and we will also undertake an assessment of the impact of wireless camera use for the Games (including airborne camera use) of the 2.6 GHz band on radars operating in the 2700–2900 MHz band.

1.6 **1980-2010/2170-2200 MHz.** These bands are allocated to the mobile satellite service for Earth-to-space and space-to-Earth service links; they are not used for programme making. However, they are located within a frequency range well suited for applications such as wireless cameras and we have taken the view that spectrum from within them could provide useful additional capacity for wireless cameras and other technologies. We are seeking agreements with commercial organisations for access to spectrum within these bands during the Games.

[1] http://www.ofcom.org.uk/consult/condocs/london2012/statement/
[2] http://stakeholders.ofcom.org.uk/consultations/band-2500-2690-london-2012-games/
[3] http://stakeholders.ofcom.org.uk/consultations/band-2500-2690-london-2012-games/

Applications

Wireless cameras

1.7 Since the publication of the Statement the most significant change has taken place around the spectrum bands that will or may be available for wireless cameras. In particular, the Ministry of Defence (MOD), the Civil Aviation Authority (CAA) and the Maritime and Coastguard Agency (MCA) have been able to agree arrangements for access to spectrum in the range 2700-3100 MHz and 3400-3600 MHz, subject to various constraints summarised in this Update. We have also consulted on reservation of the 2.6 GHz band, referred to above.

Private Mobile Radio, Talkback and Telemetry

1.8 In the Statement we said that most of the demand for private mobile radio (PMR) will be met by the network being built for the London Organising Committee of the Olympic Games and Paralympic Games Ltd (LOCOG) or the Emergency and Public Safety Services (E&PSS) network operated by Airwave Solutions Ltd. Demand outside these networks will be met from spectrum in the normal bands for PMR, talkback and Telemetry. Ofcom continues to work with stakeholders to ensure that we conserve spectrum in the range 430-478 MHz so that we can meet these needs. The demand for access to spectrum for PMR, talkback and Telemetry technologies includes the spectrum required for the UK-wide Torch Relay.

Wireless microphones and in-ear monitors

1.9 In the Statement we said that most wireless microphones will only operate in UHF Bands IV and V (470-862 MHz, channels 21 to 69). The cleared spectrum available as a result of Digital Switch Over (DSO) to Digital Terrestrial Television (DTT), including the 800 MHz band, lies in this range and will be available for the London 2012 Games.

1.10 Our assumption that sufficient spectrum will be available for wireless microphones and in-ear monitors (IEMs) is based on our knowledge of available technologies and the density with which wireless microphones and IEMs can be deployed. We have conducted further technical investigations[4] to test and confirm our assumptions about what will be feasible and remain confident that the spectrum available will be adequate to meet peak demand for wireless microphones and IEMs. However, we note that there may be a requirement for wireless CATV during the Games, which is currently expected to need 4 x 8 MHz channels. The channels needed for wireless CATV, wireless microphones and IEMs will need to be identified and their assignment prioritised to ensure that sufficient spectrum at times of peak demand for all these uses is available within the finite resources of UHF Bands IV and V.

Satellite News Gathering

1.11 We have recently set out proposals to make additional spectrum available for Transportable Earth Station (TES) satellite uplinks[5] in the frequency bands 5.925–7.075 GHz (referred to as “C band”) and 27.5–27.8185 GHz, 28.4545–28.8265 GHz and 29.4625–30 GHz (collectively referred to as “Ka band”). These additional bands are already used by other types of satellite Earth stations and would help meet

[4] http://media.ofcom.org.uk/2009/11/17/ofcom-investigates-potential-for-new-wireless-communications-technology/
[5] http://stakeholders.ofcom.org.uk/consultations/tes-additional-spectrum/

demand for Satellite News Gathering (SNG) at the venues and throughout London during the Games, in addition to the capacity in the Ku band.

Venue-specific plans

1.12 We continue to work closely with those involved in creating specific plans for locations of particular complexity. Chief among these locations are Weymouth and Portland and the Thames and Thames Estuary because the radio environments at these locations are a complex mix of land, air and sea. We are also considering a venue-specific plan for Eton Dorney because this will be the second largest transport hub within the London area. Further venue-specific plans will be created if necessary.

Next Steps

1.13 We will continue to refine the spectrum plan to clarify the detail of the access arrangements that London 2012 Games users will have to spectrum, including at a venue-specific level. We will publish supporting studies where these are needed.

1.14 We will publish a statement on the reservation of spectrum in the 2.6 GHz band later this year.

1.15 We will make available further information on our operational planning, including the arrangements for licensing, testing and tagging, monitoring and enforcement as our plans develop.

1.16 We expect to publish a final version of the spectrum plan for the London 2012 Games early in 2012.

Section 2

Introduction

The London 2012 Games

2.1 On 6 July 2005, London was chosen to host the Games of the XXX Olympiad and XIV Paralympiad. The London 2012 Games will take place between 27 July and 9 September 2012.

2.2 A number of test events will take place in the run-up to the London 2012 Games at both competition and non-competition venues. Ofcom will use these events to test the spectrum plan and our operational readiness for licensing, testing and tagging, monitoring and enforcement.

2.3 LOCOG is responsible for preparing and staging the London 2012 Games. It will be working closely with its partners to ensure it uses existing and proven technologies to deliver a robust and stable service. Wireless technologies, in particular, will play a fundamental role both in the build-up to and during the London 2012 Games as well as in associated activities (e.g. cultural events).

2.4 Ofcom is responsible for organising a full spectrum plan for the London 2012 Games, for arranging all the licences in good time in support of the plan and for ensuring wireless services are free from harmful interference. These responsibilities must be seen in the context of two guarantees given by the UK Government to the International Olympic Committee (IOC) in support of London's bid for the Games[6]. These guarantee the allocation of the spectrum required for the organisation of the London 2012 Games and the waiving of fees otherwise payable for that spectrum by members of the Olympic Family[7].

2.5 At the same time, we recognise and acknowledge the importance of services not covered by the UK Government's spectrum guarantees to the success of the London 2012 Games and the importance of "day-to-day" services. We are working to ensure that any spectrum requirements generated by the London 2012 Games and other related events and celebrations are met and coordinated with day-to-day spectrum uses so far as possible.

Purpose of this document

2.6 This Update sets out how our spectrum plan has evolved since it was published in October 2009 and how spectrum will be made available for wireless communications. In section 3 we confirm our overall approach to the spectrum plan. In section 4 we set out the details of the changes to the spectrum plan since October 2009.

[6] See Annex 1 of http://stakeholders.ofcom.org.uk/consultations/london2012/statement/
[7] See Annex 1, paragraph A1.4 of: http://stakeholders.ofcom.org.uk/consultations/london2012/statement/

Section 3

Spectrum for the London 2012 Games: overall approach

3.1 Our overall approach to the spectrum plan to meet the UK Government's spectrum guarantees with minimum disruption to other (day-to-day) users was set out in section 3 of the Statement published on 19 October 2009 ("the Statement"). Our overall approach remains that we have first sought to make use of unencumbered spectrum, and then spectrum that will require specific measures to facilitate shared access with existing users. Only in the last resort would we temporarily remove or restrict existing users from spectrum for the duration of the London 2012 Games requirement.

Securing spectrum supply

3.2 The largest supply of spectrum for the London 2012 Games has been secured from public sector bodies such as the MOD, but we have been able to secure access to some spectrum from within bands held by commercial organisations. We have sought specific agreements from those bodies and organisations to ensure that Ofcom has certainty over the spectrum access arrangements. These arrangements will be essential to ensure spectrum use during the London 2012 Games is efficient and properly coordinated and the risk of harmful interference to all spectrum users is minimised.

3.3 Under paragraph 8(5) of Schedule 1 to the Wireless Telegraphy Act 2006[8], Ofcom may at any time by giving notice in writing revoke or vary a licence if it appears to us to be necessary or expedient to do so for the purpose of securing compliance with an international obligation of the UK. The Government is able to direct us for the same purpose and has advised us that it regards its guarantees to the IOC to constitute such an obligation.

3.4 Ofcom will endeavour to explore all options to accommodate both Games and non-Games use before revoking or varying licences. At present, we do not anticipate revoking or varying existing spectrum licences to meet the requirements of the London 2012 Games, but should our assessments of demand and supply for spectrum change we may be required to do so. We do anticipate having to impose some restrictions on day-to-day spectrum use at times and in locations of peak London 2012 Games demand. We will, of course, endeavour to keep these to the minimum necessary.

3.5 To maximise the supply of spectrum for the London 2012 Games we have announced our intention[9] to defer the start date for rights to use the UK's digital dividend – the spectrum being freed up for new uses by the Digital Switch Over (DSO) from analogue to Digital Terrestrial Television (DTT) - in London until after the end of the London 2012 Games.

[8] http://www.opsi.gov.uk/acts/acts2006/pdf/ukpga_20060036_en.pdf

[9] http://stakeholders.ofcom.org.uk/spectrum/project-pages/ddr/documents/update300307/

2.6 GHz

3.6 During the London 2012 Games the demand for access to spectrum suited to wireless cameras and other key programme-making applications will be exceptionally high. Ofcom's spectrum plan as set out in the Statement was designed to satisfy the likely demand for spectrum for these technologies as we estimated it in October 2009. However experience passed to us from the Vancouver 2010 Games, evidence of further growth in the use of high definition wireless cameras for sports coverage, information on airborne television coverage and the emergence of 3-dimensional television broadcasting makes it likely that the demands on spectrum for these applications will be even greater than we then estimated.

3.7 The Statement did not include the 2.6 GHz band - even though it is highly suitable for wireless cameras and is currently used for this application - because of plans to make it available for commercial use within the timescale of the London 2012 Games. At the time we published the Statement we therefore judged the opportunity cost of reserving this spectrum for the London 2012 Games to be very high. A number of key factors have changed since then so we have consulted on the reservation of the 2.6 GHz band for wireless camera use at the London 2012 Games.

Consultation

3.8 **2.6 GHz.** The consultation on reservation of the 2.6 GHz band[10] closed on 17 September 2010. Responses supporting the proposal were received from JFMG Ltd and Everything Everywhere. A confidential response, which does not support the proposal, was also received. Two further responses were received after the closing date: one from the BBC and one other confidential response. Both of these responses strongly support the retention of this band in order to facilitate the numerous wireless cameras that will be present at the London 2012 Games.

3.9 We have published the responses from JFMG Ltd, Everything Everywhere and the BBC[11]. We have not published the two confidential responses.

3.10 The respondent who did not support our proposal suggests that we consider partitioning the band (e.g. divide it into two equal blocks with guard bands) to accommodate the needs of at least some mobile operators together with the London 2012 Games broadcasters. The respondent presents three arguments:

- it will be ready to offer LTE-based services in London in 2012 and is already building LTE capability into base stations being deployed in the Olympic Park and elsewhere; and LTE services using the 2.6 GHz band are already being launched in other countries. The respondent argues that there will therefore be the infrastructure and users to support a live service. The opportunity cost to the respondent is not "very low or zero" as we had suggested in our consultation;

- the 2.7 GHz radar remediation programme[12] could be prioritised to allow mobile services to be run in the 2.6 GHz band in 2012; and

[10] http://stakeholders.ofcom.org.uk/consultations/band-2500-2690-london-2012-games/
[11] http://stakeholders.ofcom.org.uk/consultations/band-2500-2690-london-2012-games/?showResponses=true
[12] http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-awards/awards-in-preparation/infoupdate.pdf

- the earlier that the launch of LTE services can be facilitated the better. The respondent argues that the London 2012 Games are an ideal opportunity to show-case services like HD video and gaming, thus stimulating customer interest and accelerating the take up of LTE in the UK.

Response from Everything Everywhere

3.11 Everything Everywhere ask how it will be possible to permit airborne wireless cameras in the 2.6 GHz band while prohibiting the deployment of LTE handsets because of the danger to radars operating in the 2700-2900 MHz band.

Ofcom response

3.12 The technical issue raised in Everything Everywhere's response requires further consideration, so we will undertake a further assessment of the impact of wireless camera use for the London 2012 Games (including airborne camera use) on radars operating in the 2700-2900 MHz Band. We note that wireless cameras, including airborne ones, have been permitted for many years in the 2.6 GHz band.

3.13 At this stage we do not have sufficient information in relation to the opportunity cost of reserving the 2.6 GHz band for the London 2012 Games. We are seeking the necessary additional information and will undertake a further assessment of the opportunity cost of reserving the 2.6 GHz band for Games, either in part or as a whole.

3.14 We will publish our Statement on the reservation of the 2.6 GHz band for the London 2012 Games later this year once we have completed these further assessments.

Access to the 1980-2010/2170-2200 MHz bands

3.15 We are seeking agreements with commercial organisations to use spectrum from within these bands from 28 June 2012 to 23 September 2012 and we are grateful for their co-operation in these discussions. We will publish more details about the bands we can access later this year.

Arrangements with UK public bodies

3.16 We have secured agreements on spectrum access arrangements with a number of UK public sector bodies, notably the MOD, the CAA, the MCA, the National Policing and Improvements Agency (NPIA) and the Public Safety Spectrum Policy Group (PSSPG). These bodies have agreed to make spectrum they hold or manage available for the London 2012 Games.

3.17 Through the efforts and cooperation of the NPIA, the Department for Health, the MOD, Airwave Solutions Ltd and Arqiva, spectrum for the Airwave Emergency Services network has been secured through the transfer of spectrum rights (i.e. spectrum trades). Agreements by all the public bodies, which have been recorded by the Spectrum Planning Group for the London 2012 Games (SPGOG), have been endorsed by the UK Spectrum Strategy Committee (UKSSC), the Cabinet Office committee with overall responsibility for public sector spectrum matters.

3.18 Where public sector bodies have agreed to make spectrum available, some constraints on the use of certain bands for the London 2012 Games will be needed to ensure that essential defence and safety of life services are protected. This is one reason why the spectrum plan will continue to evolve. Further information on these arrangements is given in the paragraphs below.

Arrangement with the Ministry of Defence

3.19 The MOD is the largest single supplier of spectrum for the London 2012 Games. The access arrangement for the MOD's spectrum holdings has been formalised in a Memorandum of Understanding between the Secretary of State for Defence and Ofcom. This also covers spectrum that the MOD shares and which supports essential defence and safety of life services as well as PMSE, Met Office weather radars and the Radio Amateur's Emergency Network - RAYNET[13]. The detailed band-by-band arrangements that are given in this Update may change as further information becomes available to the MOD and Ofcom.

3.20 We will continue to share our spectrum planning with defence and security services with the aim of avoiding conflicting spectrum use and minimising the likelihood of harmful interference. This is because some frequencies from within the spectrum bands identified in the spectrum plan will be needed by defence and security services under circumstances including civil contingencies and emergencies. We are working with defence and security services to develop and implement arrangements to prioritise access to spectrum and pre-empt spectrum access for these frequencies where this is appropriate, to ensure that we can maximise the availability of spectrum for the London 2012 Games without compromising essential defence and security requirements.

Arrangement with the Civil Aviation Authority

3.21 Ofcom has asked the CAA to identify spectrum currently used by aeronautical services which could be released within the London area for testing prior to and for the London 2012 Games. Access will be needed from 28 June 2012 to 23 September 2012.

3.22 We have reached agreement with the CAA on the access arrangements to specific bands, primarily to support wireless camera applications. This agreement, endorsed by SPGOG, means that the CAA will make certain frequency assignments available to Ofcom subject to a number of technical constraints and caveats, which have been analysed and determined by the CAA.

3.23 The CAA's analysis has been carried out on the basis of existing and planned aviation services and indicates the amount of spectrum available at the time of their investigation. A band-by-band summary of availability is given in Annex 2[14]. The CAA cannot guarantee that the exact frequencies indicated in their analysis can be released to Ofcom because it must plan for the ongoing needs of the aviation sector, including those arising during the London 2012 Games.

3.24 Subject to any further analysis we agree, Ofcom will ensure that the use of the frequencies released for the London 2012 Games is restricted to within the locations indicated by the CAA's analysis and that adequate interference monitoring and enforcement takes place.

[13] http://www.raynet-uk.net/
[14] Annex 2 Tables A3.5, A3.6 and A3.7

Keeping the Aviation Community informed

3.25 We will continue to work with the CAA to develop appropriate ways to advise the aviation community of Ofcom's spectrum plan including Notices to Airmen (NOTAMs).

Arrangement with the Maritime and Coastguard Agency

3.26 We have reached agreement with the MCA on the access arrangements to specific frequency bands including frequencies internationally allocated for VHF communications.

S-Band radar

3.27 The 2900-3100 MHz band will not be available at Weymouth and Portland for the sailing events. This is because ships' radar transmissions are more likely to affect TV links than vice versa, making reliable wireless camera use within the 2900-3100 MHz band difficult close to maritime environments where radar will be in use.

3.28 This means that no alteration will be made to the requirement for ships to use all appropriate means for safe navigation.

Keeping the Maritime Community informed

3.29 The MCA has raised the issue of advising mariners through their Navigation Safety Branch and information on our spectrum plan could be made available through publications including Notices to Mariners issued in 2012.

International arrangements

MOD and NATO

3.30 With the close cooperation and assistance of the UK Government, the spectrum needed for the LOCOG Tetra network has been secured from the North Atlantic Treaty Organisation (NATO). This agreement, which has been endorsed by NATO's Military Frequency Group, has required a temporary re-organisation of NATO spectrum. We are grateful for the support our plans have received from the MOD, from NATO staff and from our NATO partners and allies.

3.31 The re-organisation of the NATO spectrum band means that there should be no non-Games use of the radio channels assigned to us by NATO for the period of the Games. The terms and conditions of the spectrum licences we issue will ensure that NATO spectrum is returned at the end of the London 2012 Games. NATO will start to use this spectrum again soon after the closing ceremony of the Paralympic Games.

International frequency coordination

3.32 Some of the spectrum bands that we identified in the Statement are harmonised either world-wide or throughout Europe for specific radio services. Access to these bands is sometimes subject to international frequency coordination arrangements.

3.33 We have conducted a study of the requirement to coordinate bands identified in the spectrum plan. A summary of the current process for each band for which international frequency coordination may be required is given in Annex 2[15].

3.34 Later this year we will determine whether the technologies needed to support the London 2012 Games will need to transmit at powers that could exceed the coordination thresholds specified by existing arrangements. Our next step will be to consider whether we need to coordinate these technologies with neighbouring administrations in a detailed manner.

Cospas-Sarsat[16]

3.35 Throughout the London 2012 Games access to the bands around 400 MHz will be essential for LOCOG and the Emergency Services. We have noted and carefully considered the requirement from the MCA to protect the Cospas-Sarsat satellite network. We have carried out a detailed technical assessment of the use of spectrum around 400 MHz for the Games and concluded that the risk to Cospas-Sarsat from the use of spectrum in the 385-399.9 MHz and 407-430 MHz bands to support the London 2012 Games will be negligible. It is not necessary to use assignments in the range 399.9-407.0 MHz for the London 2012 Games.

Venue specific plans

3.36 We continue to work closely with those involved in planning for events at specific locations. Chief among these locations are Weymouth and Portland (the sailing venue) and the Thames and Thames Estuary (the River Zone, which encompasses the five main venues in the Thames Gateway area straddling the river Thames). This is because the radio environments at these locations are a complex mix of land, air and sea. We are developing spectrum plans that are specific to these areas, which take into account the requirements of the Games venues and the infrastructure that will support them as well as the requirements for day-to-day spectrum use.

3.37 VHF maritime radio channels will be used to support the sailing events at Weymouth and Portland, but will also continue to be used to meet the day-to-day operational requirements of the Port of London and the Weymouth and Portland area. Venue-specific plans have been developed in consultation with the maritime subgroup[17] of SPGOG to refine our estimate of demand for those channels and confirm the arrangements for the sailing events at Weymouth and Portland and the requirements for the Port of London.

3.38 Ofcom has taken the opportunity offered by the Skandia Sail for Gold Regatta 2010[18] to develop and test its venue-specific plan for Weymouth and Portland including developing our operational readiness for licensing, testing and tagging, monitoring and enforcement.

[15] Annex 2 Table A3.8
[16] http://www.cospas-sarsat.org/
[17] Its membership includes equipment manufacturers, British Shipping, Cowes Week Ltd, Dorset Police, LOCOG, the MCA, Ofcom, Portland Harbour Authority, the Port of London Authority, the Royal National Lifeboat Institution, the Royal Yachting Association, Weymouth Harbour Authority, Weymouth & Portland Borough Council and the MOD.
[18] http://www.sailing.org/worldcup/events/weymouth-2010.php

Eton Dorney

3.39 We are considering a venue-specific plan for Eton Dorney. This is because Eton Dorney will be the second largest transport hub within the London area and the need for a venue-specific plan has been highlighted by committees responsible for coordinating key aspects of the London 2012 Games, notably those responsible for transport. More information on a venue-specific plan for Eton Dorney will be made available as our demand assessment and planning progresses.

Football venues

3.40 We have previously examined the requirements for spectrum for the six football venues. These are existing stadia well used to accommodating broadcasting requirements at high-profile football matches and other sporting and cultural events.

3.41 We believe the spectrum requirements of the London 2012 Games will be no greater than day-to-day requirements at other high-profile football matches and will be broadly consistent across all six venues. Specifically, we forecast spectrum use at the London 2012 Games to be approximately:

- 40 channels for PMR. This is relatively low as these venues already have trunked communications systems in place designed to cater for large events. LOCOG will also be able to overlay its own PMR network if required;
- 20 channels for talkback; and
- 2 channels for wireless cameras (possibly only for the final at Wembley).

3.42 In Ofcom's view there is unlikely to be spectrum congestion at the six football venues identified for the London 2012 Games and demand can be met by coordinating spectrum requirements in advance. We do not plan to develop venue-specific plans for each of the football venues, but we will review our assessment and the implications for spectrum availability in the light of future arrangements between LOCOG and the football venue operators.

3.43 Ofcom will consider using the final of the UEFA Champions League, scheduled to take place at Wembley in May 2011, to test and verify the processes and procedures that are in development for managing the spectrum plan at that venue for the London 2012 Games.

Other events and venues

3.44 We may develop venue-specific plans for the Central Zone, which encompasses all the remaining venues within Greater London, if the information on spectrum demand indicates that such plans are needed. Other events and ceremonies where venue-specific plans may be needed include major national projects, live sites and the UK-wide cultural festival.

Major national projects

3.45 These featured in London's bid for the Games and will form the backbone of cultural activities, featuring everything from art to music to theatre. In most cases these events will be delivered in the period up to the start of the London 2012 Games. Plans include major events in London and other cities across the UK in the immediate pre-Games period.

Live sites

3.46 LOCOG plans to develop up to 60 Live Sites (temporary, mobile and permanent) – giant screens and live performance spaces – in the run up to 2012.

UK-wide cultural festival

3.47 This will feature a mix of projects in which a whole range of communities will be taking part. It is an entirely new scheme, not tried at previous Olympic or Paralympic Games.

Other events and celebrations

3.48 Some events and celebrations do not fall within the scope of the Government's spectrum guarantees. We expect the spectrum requirements they generate to be met using the day-to-day arrangements for spectrum access. If an event clearly requires use of additional spectrum beyond what can readily be supplied, we will be ready to work with the organisers to identify how their spectrum needs might be met, but organisers must understand the significance of spectrum access to the successful running of their event and the importance of effective planning to ensuring efficient arrangements for spectrum.

3.49 We do not yet have information on the demand for spectrum for the other Games venues, events and celebrations. When we do we will consider whether venue-specific plans are needed. If they are we may publish further details from time-to-time.

Section 4

The Spectrum Plan: detailed arrangements

Private Mobile Radio

4.1 This section sets out further details and changes to our plan for spectrum for PMR – land radio and maritime radio.

Land radio

4.2 LOCOG has contracted with Airwave Solutions Ltd to provide it with land radio services. Spectrum for this has been secured through our existing allocation and assignment processes, by agreements (including trading) with public sector bodies and by agreement with NATO and the MOD. The LOCOG Tetra network ("Apollo") is expected to cover all competition and other key operational venues as well as the Olympic Route Network (ORN): it should meet the needs of the great majority of Olympic Family users with requirements for PMR-like services in the London area.

4.3 Spectrum has been secured from the MOD and NATO in the 385-399.9 MHz and 407-430 MHz bands (spectrum from within the 407-430 MHz range will be used for the Airwave Emergency Services network). It remains our expectation that where requirements can be met from the LOCOG Tetra network stakeholders will adopt this solution. The demand for access to spectrum for the UK-wide Torch Relay is still being considered by LOCOG and Government. We are conserving PMR spectrum in the 430–470 MHz range until the demands are known, although we note that this range is heavily congested in the London area.

4.4 The 430–470 MHz bands could also be used for talkback, although we believe this requirement is better met from capacity in UHF Bands IV and V. We would like to accommodate land radio and handheld communications at 137-173 MHz as this spectrum is much less congested than higher bands, although some equipment will need to use spectrum from within the range 430-478 MHz.

4.5 The 430-440 MHz band is managed by the MOD and is used by Radio Amateurs. Ofcom notes RAYNET's support for the St John's Ambulance, Red Cross and other similar users as well as Amateur Special Event Stations for cultural events linked to the London 2012 Games. At past Games, Amateur radio bands (especially 430-440 MHz) have been used and this remains a possibility for the London 2012 Games if demand requires it. In the Statement we identified the bands that could be used for land mobile radio, handheld communications and talkback 19. We are now able to provide more technical detail for these bands20.

[19] see Tables 1 and 2 of section 4 of the Statement
[20] see Annex 2 Table A3.1 and A3.2

CTCSS tones and DCS codes

4.6 There is no change to our view that a requirement to use CTCSS tones and DCS codes would not be useful except where this is necessary on spectrum efficiency grounds e.g. to increase spectrum re-use.

PMR 446 equipment

4.7 PMR 446[21] will be able to use eight 12.5 kHz simplex channels anywhere in the UK on a licence exempt basis, although within the Games venues there may be additional coordination requirements or it may not be allowed at all. Further information is given in section 5 of the Statement.

4.8 In section 5 of the Statement we highlight that it may be necessary to introduce additional coordination arrangements for licence exempt use within London 2012 Games venues. We are currently developing these arrangements and will publish details, including how they will relate to PMR 446, in due course.

Maritime radio

4.9 Maritime radio will be used to support the sailing events at Weymouth and Portland and to support the Games in London, but it will also continue to be used to meet the day-to-day operational requirements of the Port of London and Weymouth and Portland, which may increase significantly during the Games. Venue-specific plans are in development, which will address new spectrum demands to meet the day-to-day operational requirements and spectrum will be set aside for this purpose.

4.10 In addition to meeting the increased demand for spectrum to support the day-to-day operational requirements of the Port of London and the Weymouth and Portland area we will make use of unused capacity in the maritime VHF radio channels to support the Games at Weymouth and Portland. This includes 35 dual-frequency channels (of which up to 33 can be split into single-frequency channels) and 17 single-frequency channels. We have already coordinated the temporary use of these channels.

4.11 The dual-frequency and single-frequency maritime channels that may be made available are given in Tables 4 and 5 of the Statement. The use of these channels will be constrained by some planning and operational arrangements (which Ofcom may include as licence conditions) that take into account the locations of use and the use of channels for ship-to-ship communications. Channels for single-frequency and dual-frequency working may require re-programming, and possibly modification of the equipment.

Wireless Microphones and IEMs

4.12 In the Statement we said that most wireless microphones will only operate in UHF Bands IV and V, sharing with analogue and Digital Terrestrial Television (DTT). The cleared spectrum available as a result of the switchover to DTT, including the 800 MHz band, will be available for the London 2012 Games.

[21] A higher power version with base stations is sometimes referred to in the United States of America as “Family Radio Service”.

4.13 We still anticipate that some 39 channels (each of 8 MHz, totalling up to 312 MHz) will be made available by holding back rights of new use of the spectrum that will comprise the UK's digital dividend until after the London 2012 Games. This assessment is still based on a number of assumptions about those processes, including the implementation of proposals on which we and the Government have yet to make final decisions; and the outcome of negotiations with neighbouring countries to coordinate future use of UHF Bands IV and V.

4.14 We have conducted further technical investigations to test our assumptions about what will be feasible and remain confident that the spectrum available will be adequate to meet peak demand for wireless microphones and IEMs. A summary of the bands for wireless microphones and IEMs is given in Table 7 of the Statement. However, we note that there may be a requirement for wireless CATV during the Games, which is currently expected to need 4 x 8 MHz channels. The channels needed for wireless CATV, wireless microphones and IEMs will need to be identified and their assignment prioritised to ensure that sufficient spectrum for all these uses is available within the finite resources of UHF Bands IV and V.

4.15 Channel 70 is used for licence exempt equipment and will be available for wireless microphones at Games time. Ofcom is aware that a large number of wireless microphones are already operated on channel 70 (approximately 1500 according to information provided by MLEC UK Ltd) by London Underground throughout London for making station and platform announcements. London Underground's use of wireless microphones on channel 70 is on a licence exempt basis and is therefore unprotected from other licence exempt and licensed uses. We think the risk of interference to London Underground's services or to the use of channel 70 for the London 2012 Games should be investigated and we will do this as part of our planning.

Talkback

4.16 Talkback is used by broadcasters, allowing producers to give directions to production team members such as camera operators, reporters and presenters. We have forecast demand for 410 channels in the Olympic Park, 260 in the River Zone and 111 in the Central Zone. The bands that will be available for talkback are given in Table 8 of the Statement. We are now able to provide more technical detail for talkback in these bands[22].

Audio Distribution Services

4.17 Audio distribution services (ADS) re-transmit material already prepared for public use. They cover events and other temporary purposes.

4.18 Spectrum for Live ADS will be available so that everyone, including blind and partially sighted people, will have equal access to the London 2012 Games, including the Opening and Closing Ceremonies, Torch Relays and medal ceremonies. The frequencies needed for this service are under discussion with LOCOG and depend on the technical solution chosen. Ofcom may allow ADS to operate in frequency bands other than the 60.75-62.75 MHz band if demand requires it. We may allocate spectrum from within the blocks of 4 MHz of spectrum above and below 60.75 to 62.75 MHz that is unused in the range 55 MHz to 68 MHz for this purpose.

[22] See Annex 2 Table A3.2

Video links

4.19 Video links include both wireless camera and point-to-point link technologies. They are used by broadcasters for capturing and reporting live events and by closed-circuit television for security purposes. New demands for spectrum for video links are emerging from our venue-specific plans.

Wireless cameras

4.20 Since the publication of the Statement the most significant change has taken place around the spectrum bands that will or may be available for wireless cameras. This includes the consultation on reservation of the 2.6 GHz band referred to in paragraphs 3.6-3.14 above. Demand for spectrum for wireless cameras in the 1-3 GHz range is very high. While there is some availability in the 1-3 GHz range we encourage those who are willing and able to use frequencies above 3 GHz, where availability is greater, to do so whenever possible.

4.21 The spectrum that we will make available is set out in Table 9 of the Statement. Further technical details for these bands and for the new bands that we have included are given in Annex 2[23].

Change to demand

4.22 Wireless camera use is directly linked to broadcasting requirements. With perhaps 200 rights-holding broadcasters (RHBs) active at the London 2012 Games, even if not all of them use wireless cameras we expect this to be by far the largest spectrum requirement. Moreover, wireless cameras are more susceptible to harmful interference than many other applications.

4.23 In the Statement we said that we will need to accommodate a peak of up to 75 wireless camera channels in simultaneous use. However, we are now assuming that many of these channels will need to accommodate high definition 3D TV broadcasts, which implies that more spectrum will be needed. This is based on:

- a peak of 36 channels experienced at the Beijing Games;
- the scope to reuse spectrum between London 2012 Games venues; and
- an allowance for growth given how production values (e.g. point-of-view cameras) have taken advantage of developments in HD and 3D technologies. We think this might be as high as the demand experienced at the Beijing Games plus 20% or more.

4.24 Planning on the basis that using adjacent channels is not possible without causing harmful interference leads to a maximum peak requirement for 149 channels if they are all contiguous, though we anticipate being able to reduce the frequency offset between two co-located adjacent channels to 5 MHz (and even less as the cameras move away from each other geographically) if users adopt best site management and engineering practices.

[23] Annex 2 Tables A3.4, A3,6 and A3.7

New bands and significant changes

4.25 Spectrum within a number of new and existing bands will or may be available:

- 1980-2010/2170-2200 MHz bands. Some spectrum from within these bands could provide additional analogue FM channels and digital DVB-T channels;
- the 2500-2690 MHz band, which could provide additional analogue Frequency Modulation (FM) channels and digital DVB-T channels;
- some constrained use of the 2700-3100 MHz band. As a proportion of the 2700-3100 MHz band use is mobile and ship-borne, any interference management arrangement is likely to be complex, particularly at Weymouth and Portland and the Thames and Thames estuary. For this reason Ofcom will consider access for wireless cameras in the other bands identified for this technology before considering assignments in the 2700-3100 MHz range; and
- wireless camera channels in the 3400-3600 MHz band[24].

4.26 The 3100-3400 MHz band is used for essential military land, airborne and naval radars. Capacity within this band could be made available for low power (e.g. 100mW or less) wireless cameras at the London 2012 Games, but any use by wireless cameras would be at risk of interference from these NATO military systems.

Broad Band Disaster Relief (BBDR) radio applications in the 5 GHz range

4.27 The European Conference of Postal and Telecommunications Administrations (CEPT) has recommended[25] a number of preferred bands around 5 GHz for BBDR. This may mean that Ofcom will need to prioritise the use of the band 4940-4990 MHz under circumstance of emergency or disaster.

4.28 The technical parameters for BBDR equipment are as follows:

- for BBDR Base Stations, the spectral power density should not exceed 26 dBm/MHz e.i.r.p. per base station; and
- for BBDR User Equipment, the spectral power density should not exceed 13 dBm/MHz e.i.r.p.

4.29 However, we would expect BBDR radio applications not to claim protection from nor cause interference to the use of the bands by technologies supporting the London 2012 Games.

Point-to-point links

4.30 Point-to-point link technologies could be used to connect venues or to provide video signals to an outside-broadcast (OB) truck for example; though the need for these technologies has reduced over the years and optical fibre is often used for backups and intra-venue links.

[24] http://www.ofcom.org.uk/consult/condocs/3_4ghz/
[25] ECC Recommendation (08)04: The identification of frequency bands for the implementation of Broad Band Disaster Relief (BBDR) radio applications in the 5 GHz frequency range

4.31 The bands we will make available are given in Table 10 of the Statement.

Other guaranteed services

4.32 This section sets out further information in support of our assessment and proposals for other guaranteed services – satellite services, telemetry and telecommand and WLANs.

Fixed satellite services

4.33 Fixed satellite services (FSS) use earth stations operating at known locations that transmit and receive to and from satellites. At the London 2012 Games, FSS will be used by broadcasters to carry video and audio feeds from outside broadcast (OB) venues to studios or directly to national and international broadcasting networks. We understand two different applications will be used:

- Permanent Earth Stations (PES); and
- Transportable Earth Stations (TES), predominantly used for satellite news gathering (SNG).

PES

4.34 PESs are used to communicate to and from a known location with a satellite located in a geostationary orbit. We expect there may be demand for a limited number of short-term licences for PES at some venues, including the IBC and Weymouth and Portland.

4.35 As PESs are planned well in advance and at known fixed locations, we expect the spectrum requirements they generate to be met using Ofcom's normal arrangements. Authorisations are available in the bands shown in Table 11 of the Statement.

TES

4.36 We continue to expect the demand for satellite news gathering (SNG) to be high at London 2012 Games venues and throughout London during the Games. We will pre-coordinate SNG operations at London 2012 Games venues in order to streamline our licensing processes and support the very rapid deployment of SNG within those venues.

4.37 We have recently set out proposals to make additional spectrum available for TES satellite uplinks[26] in order to meet demand from stakeholders and to relieve excessive demand on satellite capacity in the currently licensed frequency band 13.78–14.5 GHz (referred to as "Ku band").

Mobile satellite services

4.38 Mobile satellite services (MSS) operate globally through a number of geostationary and non-geostationary satellite constellations, normally with their service links in the range 1-3 GHz. They support general consumer voice communications and

[26] http://stakeholders.ofcom.org.uk/consultations/tes-additional-spectrum/

broadband video and data transmissions. In addition, they provide communication links for defence and security services that are independent of terrestrial networks[27].

4.39 Spectrum for MSS is already available with restrictions in certain locations when absolutely necessary, both inside and outside the Olympic Park.

4.40 MSS terminals (excluding aircraft earth stations) are licence exempt. The available bands for MSS are set out in Table 13 of the Statement.

1980-2010/2170-2200 MHz

4.41 These bands are allocated to the mobile satellite service for Earth-to-space and space-to-Earth service links and they are not used for programme making. However, they are located within a frequency range well suited for applications such as wireless cameras and we have taken the view that reserving spectrum from within them for the London 2012 Games could provide useful additional capacity for wireless cameras and other technologies. We are working with the users of these bands to determine what access is available in 2012.

Amateur-Satellite Service

4.42 We do not think it will be necessary to use the frequency bands allocated to the Amateur-Satellite Service, but we will retain the option to consider whether there is a requirement to use them as we develop our venue-specific spectrum plans. We will continue to work closely with key stakeholders as we develop our plans.

Radionavigation satellite services

4.43 Radionavigation satellite services (RNSS) provide signals for security, business and consumer devices. Radionavigation satellite constellations such as the global positioning system (GPS) all transmit location-based positioning and timing signals. These systems, especially GPS, are used everywhere to allow accurate location determination, timing and synchronisation.

4.44 LOCOG, in its response to our consultation on a draft spectrum plan28, stressed the heavy use of and reliance on GPS technologies for timing, location determination and other London 2012 Games purposes. For this reason we are developing operational plans that are venue and technology specific to ensure as far as we are able that GPS reception is uninterrupted during events that rely on GPS-based technologies for timing, location determination and synchronisation.

4.45 With the assistance of Government, Ofcom has secured an arrangement to ensure that intentional GPS jamming trials do not take place during the period of the London 2012 Games. RNSS receivers are licence exempt. The available bands are set out in Table 14 of the Statement.

[27] www.cabinetoffice.gov.uk/ukresilience/preparedness/resilient_telecommunications/enhancing/catalogue.aspx.

[28] 27 May 2009

Telemetry and Telecommand

4.46 Telemetry and telecommand technologies will be used at the London 2012 Games to control cameras, camera shutters and other equipment remotely and for localised data communications.

4.47 A range of spectrum is available for telemetry and telecommand technologies on a licence exempt basis. Some of the available bands are set out in Table 15 of the Statement. Further technical details are given at Annex 2 of this Update.

Wireless CATV

4.48 Wireless CATV is an OBS project, still in the pilot phase, to provide news flashes to RHBs via handheld devices. If it is deployed at the London 2012 Games, wireless CATV would provide local venue-wide coverage for a number of venues to a closed user group. OBS has not yet decided the venues at which it would be deployed (if at all).

4.49 Wireless CATV, as currently piloted, would need an 8 MHz channel in UHF Band IV or V and the current estimate of demand is for 4 x 8 MHz channels. The exact type, height and location of antennas would be specific to each venue, but OBS envisages a low-power solution adequate only to cover areas within that venue. As UHF Bands IV or V are also identified for wireless microphones and IEMs, the channels needed for wireless CATV, wireless microphones and IEMs will need to be identified and their assignment prioritised to ensure that sufficient spectrum for all these uses is available within the finite resources of UHF Bands IV and V.

Licence exempt spectrum

4.50 Spectrum for licence exempt equipment is identified by service category for the London 2012 Games in Table 16 of the Statement. Further bands are available for Short Range Devices (SRDs). Further information on SRD bands can be found in the UK Frequency Allocation Table[29]. For detailed information on the regulations and technical usage please refer to IR 2030[30].

4.51 Section 5 of the Statement highlights that, due to the anticipated high level of use of licence exempt spectrum at London 2012 Games venues, it might be necessary to introduce additional coordination arrangements for exempt equipment. We will publish details of any such arrangements in due course.

4.52 However, whatever arrangements Ofcom may decide to implement, these are unlikely entirely to remove the risk of congestion. For this reason we recommend that, wherever possible, Games-critical applications should avoid using licence exempt bands.

4.53 The bands for licence exempt equipment are given in Table 16 of the Statement.

Spectrum for remote camera shutter control

4.54 A further use of SRDs was identified, but not included, in Ofcom's review of radio spectrum use for the London 2012 Games: radio remote control (low power) devices to trigger cameras and the wireless adaptors that are used to transmit pictures by the

[29] See Annex B of the UK Frequency Allocation Table: http://www.ofcom.org.uk/radiocomms/isu/ukfat/
[30] IR2030 can be found at: http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/IR2030final.pdf

press. Wireless adaptors generally use low power WLAN links either though wireless hotspots or to wireless enabled laptops.

4.55 The risk of interference both from remote control camera shutter control devices and from WLAN links for picture transmission is low, but both may be swamped by other, more powerful, radio equipment operating in the vicinity. Where radio remote control (low power) devices to trigger cameras and the wireless adaptors that are used to transmit pictures by the press operate within licence exempt spectrum on a licence exempt basis they are unprotected from other licence exempt and licensed uses.

Wireless Local Area Networks

4.56 WLANs are also known as Wi-Fi and hot spots. WLANs and access will be provided by LOCOG for the press and other media, although LOCOG and its partners will be designing venues to maximise wired connectivity.

4.57 We are still exploring with LOCOG how such use can best be controlled and coordinated to avoid any disruption to the smooth running of the London 2012 Games. Practical measures (e.g. preventing certain types of equipment from being brought into London 2012 Games venues or actively coordinating use between users) have proved successful at past Games. LOCOG has not yet made decisions about the controlled or coordinated use of Wi-Fi and WLANs, but controlling use of the 2400 MHz and 5000 MHz bands could help to reduce congestion for WLANs and harmful interference to other services.

4.58 The Met Office raised concerns in its response to our consultation on a draft spectrum plan about the need to protect the use of its radars and the importance of the information provided by these radars to the London 2012 Games. We have included this requirement in our plans for monitoring and will consider how WLAN use can best be controlled or coordinated to avoid any disruption to the meteorological radars.

4.59 Table 16 of the Statement sets out the available bands for WLANs on a licence exempt basis, maximum power levels and applicable UK Interface Requirements.

Non-guaranteed services

Introduction

4.60 As set out in Annex 1 of the Statement, we have agreed with the Government that its spectrum guarantees do not apply to many services that will nonetheless require access to spectrum during the London 2012 Games. This section divides those services into two categories – public and private – and sets out how they may secure access to the spectrum they need.

Public services

4.61 Ofcom continues to work closely with the public sector to scope the demand for spectrum for public services during the London 2012 Games and to coordinate Ofcom's spectrum plan and those required by public sector bodies for emergency and security purposes, including the security and operation of the Games.

4.62 We still envisage that public services with non-guaranteed spectrum requirements generated by the unique nature of the London 2012 Games will meet them from

existing assignments or the market. Government direction and administrative assignment would be necessary only if an exception is justified. We will nonetheless seek to ensure that these requirements can be met. We will also ensure that spectrum used for non-guaranteed public services is coordinated with spectrum for guaranteed services where this coordination is needed. We will continue to work closely with the emergency and public safety services, defence, security and transport services to ensure that their expected requirements for the London 2012 Games are met.

Private services

4.63 Non-guaranteed private services primarily improve the experience of the London 2012 Games, some significantly so, but these are not directed by LOCOG or others directly responsible for the organisation of the London 2012 Games. Any spectrum requirements for non-guaranteed private services generated by the unique nature of the London 2012 Games will have to be met through the market and existing assignment processes.

4.64 At the same time, we recognise and acknowledge the importance of those services not covered by the Government's spectrum guarantees to the success of the London 2012 Games and the importance of day-to-day services. We are working to ensure that any spectrum requirements generated by the London 2012 Games are met and coordinated with day-to-day spectrum uses.

Non-rights-holding broadcasters

4.65 Arrangements for access to spectrum for non-rights-holding broadcasters will be set out when we publish our arrangements for licensing for the London 2012 Games (see section 5 of the Statement).

Public mobile communications

4.66 The UK mobile network operators (MNOs), LOCOG and the ODA have been developing their plans for public mobile communications coverage for the Olympic Park for some time and the MNOs' requirements were included in the proposed telecommunications strategy for provision of cellular services which the ODA has agreed with LOCOG.

4.67 LOCOG will lead on the coordination, planning and provision of any temporary radio-distribution infrastructure required within London 2012 Games venues. This will primarily be for emergency and public safety services and its own operational requirements, but may incorporate public mobile communications coverage if requested by the MNOs. The ODA will continue to lead on any issues relating to legacy coverage requirements within the Olympic Park.

Short-term restricted-service licences (S-RSLs)

4.68 S-RSLs are granted for covering special events, special projects (e.g. training) and trial services (e.g. in preparing to apply for a community radio licence). However, FM spectrum for such services (particularly within the Greater London area) is invariably in short supply. Subject to competing demands for S-RSL spectrum, it may be possible to license one or more such short-term, small area, analogue radio services dedicated to a specific (e.g. sporting or cultural) aspect of the London 2012 Games.

Annex 1

Equality Impact Assessment

A1.1 We are required by statute to have due regard to any potential impacts our proposals may have on race, disability and gender equality – an Equality Impact Assessment (EIA) is our way of fulfilling this obligation and ensuring that we meet our duty of furthering the interests of citizens and consumers. Ofcom will also consider any relevant wider equality issues. We identified three potential impacts on equality in relation to the Statement and we discuss them and update our assessment and plans below. As parts of the spectrum plan and our policies on licensing and interference management during the London 2012 Games will evolve over time, we intend to monitor equality issues in relation to our work on the London 2012 Games on an on-going basis.

Live and Broadcast Audio Description Services

A1.2 Spectrum for Live ADS will be available so that everyone, including blind and partially sighted people, will have equal access to the London 2012 Games, including the Opening and Closing Ceremonies, Torch Relays and medal ceremonies. The frequencies needed for this service are under discussion with LOCOG and depend on the technical solution chosen. In relation to Broadcast ADS, the broadcasters already have sufficient spectrum for the provision of television audio description.

A1.3 Our test plan includes an opportunity to test both Live and Broadcast ADS.

Day-to-day spectrum use

A1.4 At present, we do not anticipate revoking or varying existing spectrum licences to meet the requirements of the London 2012 Games. Should our assessment of demand and supply for spectrum change, we may be required to do so. This may have a socio-economic impact, which we will assess if a requirement to revoke or vary licences is identified. We do anticipate having to impose some restrictions on day-to-day spectrum use at times and in locations of peak London 2012 Games demand. We will, of course, endeavour to keep these to the minimum necessary and we will assess the impact on equality when the requirement has been more precisely identified.

Religious holidays and festivals

A1.5 The London 2012 Games will take place during the Ramadan religious period. Each year we typically license a number of short duration, radio-broadcasting services for use throughout Ramadan and Eid. These short-range, very local, stations are licensed as RSLs (Restricted Service Licences) and in London we are usually able to find frequencies for about three such services. Applications for these Ramadan RSL broadcasts almost always exceed our available supply of frequencies and licensing three or more such stations in London uses up our very limited available FM capacity within the capital, leaving no viable capacity for additional small-scale services.

A1.6 Our normal process for assigning RSL frequencies involves a window for application one year in advance. Ofcom issued detailed guidance[31] on this process in April 2010 and we expect to use this process in 2011 for services in the summer of 2012. All applications received in conformity with this guidance will be dealt with in the same way.

[31] http://licensing.ofcom.org.uk/radio-broadcast-licensing/restricted-service-licences/

Annex 2

Further Technical Information on Spectrum Bands

A2.1 In this Annex we set out further technical information relating to the bands identified for the technologies needed to support the London 2012 Games.

Table A2.1 Land Radio

Band (MHz)	Channel bandwidth	Estimated number of simplex channels	Estimated number of duplex channels	Technical Restrictions for intended application (max ERP) Ground Use
68.081250-87.49375	12.5kHz	7	74	50W (25W mobile) See IR2044
70.5-71.5	6.25kHz 12.5kHz 25kHz	72 national channels minus the number of channels used for duplex pairing with 80.5-81.5MHz	-	25W 50W 100W (25W mobile) See IR2044
80.0-81.5	6.25kHz 12.5kHz 25kHz	82 national channels minus the number of channels used for duplex pairing with 70.5-71.5MHz	Up to 72 duplex channels	25W 50W 100W (25W mobile) See IR2045
137.9625-138.0375	25kHz	1 x 25kHz channel	0	100W (25W mobile) See IR2044
138.1125-138.2125	25kHz	1x25kHz	0	100W (25W mobile) See IR2044
143-144	6.25kHz 12.5kHz 25kHz	48 channels total (34 additional channels plus 14 additional national channels in London)	0	25W 50W 100W (25W mobile)

Band (MHz)	Channel bandwidth	Estimated number of simplex channels	Estimated number of duplex channels	Technical Restrictions for intended application (max ERP) Ground Use
146-148	6.25kHz 12.5kHz 25kHz	86 Total (60 national plus 26 additional channels in London)	0	25W 50W 100W (25W mobile)
152-156	6.25kHz 12.5kHz 25kHz	158 channels total (104 national plus 54 additional channels in London)	-	25W 50W 100W (25W mobile)
168.31250-168.83750	12.5kHz	7 national channels total (only 6 of which will be available in London)	-	50W (25W mobile) See IR2044
173.98750-174.41250	12.5kHz	25 national channels	-	50W (25W mobile) See IR2045
193.2-207.5	12.5kHz	7x12.5kHz (5 x base Tx) (2x mob Tx)	337x 12.5kHz	50W 25W mobile See IR2044
425.00625-449.49375 (same as 420-450)	6.25kHz 12.5kHz 25kHz	11 channels: 2x6.25kHz 8x12.5kHz 1x25kHz	2x25kHz Plus 25x25kHz plus an additional 2x25kHz	50W (25W mobile) See IR2044
446.00625-446.09375	12.5kHz	8 analogue	0	500mW
446.10625-446.19375	6.25kHz	16 digital	0	500mW

Band (MHz)	Channel bandwidth	Estimated number of simplex channels	Estimated number of duplex channels	Technical Restrictions for intended application (max ERP) Ground Use
450-470	12.5kHz	242 (172 national plus 70 additional in London)	Possible to make some channels duplex, subject to planning	50W (25W mobile) See IR2044
453.00626-466.08750	6.25kHz 12.5kHz 25kHz	2 x 6.25kHz and 1 x 25kHz	0	25W 50W 100W (25W mobile) See IR2044
870-872	12.5kHz	-	(Paired with 915-917)	2W
915-917	12.5kHz	-	(Paired with 870-872)	2W

Table A2.2 Talkback

Band (MHz)	Channel bandwidth	Simplex / Duplex	Technical Restrictions for intended application (max ERP) Ground Use
47.55-48.8	Min 12.5kHz Max 200kHz	Either (paired with 52MHz band which is only 0.95MHz wide)	25W
52.0-52.95	Min 12.5kHz Max 200kHz	Either (paired with 47MHz band)	10W
74.68125-74.71875	25kHz	Simplex	10W

Band (MHz)	Channel bandwidth	Simplex / Duplex	Technical Restrictions for intended application (max ERP) Ground Use
75.26250-75.300	25kHz	Simplex	10W
76.80625-76.84375	12.5kHz	Either (paired with 86MHz)	25W
78.18375-78.25875	12.5kHz	Simplex	25W
86.80625-86.84375	50kHz	Either (paired with 76MHz)	25W
140.98750-141.0	12.5kHz	Either (paired with 212MHz)	25W
141.0-141.48750	12.5kHz	Simplex	25W
181.69375-181.80625	12.5kHz	Simplex	25W
189.69375-189.80625	12.5KHz	Simplex	25W
211.91875-212.19375	12.5KHz	Either (paired with 141 MHz)	25W
427.7625-428.0125	12.5kHz	Either (paired with 469MHz)	25W
442.2625-442.5125	12.5kHz 25kHz	Either (paired with 455MHz 457MHz and 462MHz)	25W
446.425-446.5125	Min 12.5kHz Max 200kHz	Either (paired with 467MHz band)	5W

Band (MHz)	Channel bandwidth	Simplex / Duplex	Technical Restrictions for intended application (max ERP) Ground Use
454.98750-455.4750	Min 12.5kHz Max 200kHz	Either (paired with 467MHz band)	5W
457.25000-457.47500	12.5kHz	Either (paired with 467MHz band)	5W
461.23125-461.25625	12.5kHz	Either (paired with 468MHz band)	25W
462.75000-463.00000	-	Either (paired with 469MHz band)	-
467.2625-469.8750	12.5kHz	0.075	25W
470-478	12.5kHz	Either	25W
494-502	12.5kHz	Either	25W

Table A2.3 High Power Audio links

Band (MHz)	Channel bandwidth	Technical Restrictions for intended application (max ERP) Ground Use
48.425, 48.475, 48.525, 52.875, 52.925	50kHz	10W
48.3, 52.7	200kHz	10W
53.7-55.75	75kHz	5W

Band (MHz)	Channel bandwidth	Technical Restrictions for intended application (max ERP) Ground Use
60.75-62.75	75kHz	5W
191.7, 199.8, 199.9, 200.1	200kHz	1W
215.26875-215.49375	75kHz	25W
425.3375, 425.3875, 425.4375, 425.4875, 425.5375	50kHz	25W
446.5125-447.5125 454.9875-455.4750	50kHz	25W
467.2625-469.875	50kHz	25W
1488-1491	500kHz	20dBW
1517-1525	500kHz	20dBW

Table A2.4 Wireless Cameras

Band (MHz)	Channel bandwidth	Technical Restrictions for intended application (max ERP) Ground Use	Technical Restrictions for intended application (max ERP) Airborne Use
1300-1320	10MHz	Venue specific, see table A2.6	N/A
1660-1670	10MHz	Initial estimate is max ERP -20dBW in London locations. ITU interference threshold assumed: -220dBW to protect RAS. In the UK the protection level for 1660.5-1670MHz band is -194 dBW/20KHz	N/A
2010-2025	10MHz	≤20dBW in 10MHz	N/A
2025-2110	10MHz	(75MHz usable) ≤20dBW in 10MHz	≤13dBW in 10MHz
2200-2300	10MHz	≤20dBW in 10MHz	N/A
2310-2390	10MHz	≤20dBW in 10MHz	N/A
2390-2410	20MHz	≤20dBW in 20MHz	N/A
2483-2500	10MHz	≤20dBW in 10MHz	N/A
2500-2690	10MHz / 20MHz	See paragraphs 3.8-3.14 ≤20dBW in 10MHz	See paragraphs 3.6-3.14 ≤13dBW in 10MHz
2700-3100	10MHz	Venue specific, see table A2.7	N/A
3100-3400	10MHz / 20MHz	≤20dBW in 10MHz	≤13dBW in 10MHz
3400-3440, 3500-3580	10MHz / 20MHz	≤13dBW 3400-3420MHz ≤30dBW 3420-3440MHz ≤40dBW 3500-3580MHz	≤13dBW 3400-3420MHz ≤30dBW 3420-3440MHz ≤40dBW 3500-3580MHz

Band (MHz)	Channel bandwidth	Technical Restrictions for intended application (max ERP) Ground Use	Technical Restrictions for intended application (max ERP) Airborne Use
3690-3920	10MHz	100mW but higher powers maybe possible Earth Station analysis: max ERP of 500mW at Dorney Lake and 1W Olympic Park, other venues may use higher powers.	N/A
4010-4200	10MHz	100mW but higher powers maybe possible Earth Station analysis: max ERP of 500mW at Dorney Lake and 1W Olympic Park, other venues may use higher powers.	N/A
4400-4800	10MHz	Limited access subject to coordination and agreement with MOD	N/A
5472-5588	10MHz	40dBW	N/A
5682.5-5702.5	20MHz	40dBW	23dBW
5705-5725	20MHz	40dBW	N/A
5732.5-5752.5	20MHz	40dBW	N/A
5770-5790	20MHz	40dBW	23dBW
5795-5815	10MHz	40dBW	N/A
5850-5875	20MHz	40dBW	13dBW
5905-5925	20MHz	40dBW	13dBW

Band (MHz)	Channel bandwidth	Technical Restrictions for intended application (max ERP) Ground Use	Technical Restrictions for intended application (max ERP) Airborne Use
5925-7125	10MHz	100mW but higher powers maybe possible Earth Station analysis: max ERP of 500mW at Dorney Lake and 1W Olympic Park, other venues may use higher powers.	N/A
7125-7250	20MHz	40dBW	13dBW
7300-7322.5	20MHz	40dBW	N/A
7300-7425	20MHz	40dBW	N/A
8460-8500	20MHz	40dBW	N/A
61000-61500	20MHz	40dBW	N/A

Table A2.5 Frequencies and maximum permissible EIRPs for wireless camera use at specific venues in spectrum managed by the CAA for aviation purposes

A2.2 The CAA's indicated potential spectrum release is given in the Tables A2.5 to A2.7. The CAA cannot guarantee that the exact frequencies indicated in the tables can be released to Ofcom because it must plan for the ongoing needs of the aviation sector, including those arising during the London 2012 Games.

Frequency Band	Potential for Games Use
960-1215MHz	Potential to use 960-977MHz subject also to MOD agreement with respect to JTIDS.
1215-1350MHz	The maximum radiated powers (ERP) for wireless cameras to be compatible with CAA systems within this band can be viewed in Table A2.6 below.

Frequency Band	Potential for Games Use
2700-3100MHz	The maximum radiated powers (ERP) for wireless cameras to be compatible with CAA systems within this band can be viewed in Table A2.7 below.
5030-5091MHz	Two frequencies are in use at Heathrow and must be protected. Elsewhere spectrum may be available.
5091–5150MHz	This band is currently not in use and hence may be available.

Table A2.6 Maximum Radiated Powers (ERP) for Wireless Cameras to be compatible with CAA systems within 1215-1350MHz

Location	Frequencies (MHz) and Maximum Radiated Powers (ERP) for Wireless Cameras				
	13dBW	8dBW	3dBW	-3dBW	-10dBW
Olympic Park	1292-1307 1215-1244				
Excel Centre	1336-1350 1292-1315 1215-1271	1343-1350 1270-1307 1215-1244			
O2 Arena	1343-1350 1292-1307 1215-1244				
Regents Park	1292-1307 1215-1244				
Hyde Park	1292-1307 1215-1244				
Wimbledon	1292-1307 1215-1244				
Wembley stadium	1292-1307 1215-1244	1270-1307 1215-1244			
Earls Court	1286-1328 1215-1244	1270-1307 1215-1244			
Lords	1292-1307 1215-1244		1270-1307 1215-1244		
Horse Guards	1292-1307 1215-1244	1270-1307 1215-1244			
Greenwich	1292-1307 1215-1244		1270-1307 1215-1244		
Royal Artillery Barracks	1292-1307 1215-1244				
Broxbourne	 1292-1307 1215-1244	1336-1350 1292-1315 1215-1271			
Eton Dorney	1292-1315 1215-1244	1270-1307 1215-1244			
Stratford	1292-1307 1215-1244	1270-1307 1215-1244			

Table A2.7 Maximum Radiated Powers (ERP) for Wireless Cameras to be compatible with CAA systems within 2700-3100MHz

Location	Frequencies (MHz) and Maximum Radiated Powers (ERP) for Wireless Cameras				
	13 dBW	8 dBW	3 dBW	-3dBW	-10dBW
Olympic Park	2821-2850 2741-2755				2785-2905 2700-2755
Excel Centre	2821-2850 2741-2755 2700-2720				
O2 Arena	2821-2850 2741-2755 2700-2720				
Regents Park	2821-2850 2700-2710		2741-2755 2700-2720		
Hyde Park	2821-2850 2700-2710		2741-2755 2700-2720		
Wimbledon	2821-2850 2700-2710			2741-2755 2700-2720	
Wembley stadium	2700-2710	2821-2850	2741-2755 2700-2720		
Earls Court	2821-2850 2741-2755 2700-2720				
Lords	2821-2850 2700-2710		2741-2755 2700-2720		
Horse Guards	2821-2850 2700-2710		2741-2755 2700-2720		
Greenwich	2821-2850 2741-2755 2700-2720				
Royal Artillery Barracks	2821-2850 2741-2755 2700-2720				
Broxbourne	2785-2875 2700-2755				
Eton Dorney	2821-2850 2700-2710	2741-2755 2700-2720			
Stratford	2821-2850 2741-2755				2785-2905 2700-2755

Table A2.8 International coordination arrangements

Frequency band	Coordination Arrangement
68.08125-87.49375MHz	There is an existing Ofcom process and an existing technical basis for coordinating assignments at the point of licensing. If the signal calculated at the border of the affected administration exceeds the agreed coordination threshold then it should be coordinated. If not then coordination is unnecessary.
137-173MHz	There is an existing Ofcom process and an existing technical basis for co-ordinating assignments at the point of licensing. If the signal calculated at the border of the affected administration exceeds the agreed coordination threshold then it should be coordinated. If not then coordination is unnecessary.
174.000-193.200MHz	There is an existing Ofcom process and an existing technical basis for coordinating assignments at the point of licensing. The coordination uses Band III methodology that is subject to international coordination. A licence is not issued if coordination fails.
193.2-207.5MHz	There is an existing Ofcom process and an existing technical basis for coordinating assignments at the point of licensing. The co-ordination uses Band III methodology that is subject to international coordination. A licence is not issued if coordination fails.
430-440/450MHz	There is an existing Ofcom process and an existing technical basis for coordinating assignments at the point of licensing. If the signal calculated at the border of the affected administration exceeds the agreed coordination threshold then it should be coordinated. If not then coordination is unnecessary.
446.000-446.100MHz	No coordination required
446.100-446.200MHz	No coordination required

Frequency band	Coordination Arrangement
450-470MHz	There is an existing Ofcom process and an existing technical basis for coordinating assignments at the point of licensing. If the signal calculated at the border of the affected administration exceeds the agreed coordination threshold then it should be coordinated. If not then coordination is unnecessary.

Annex 3

Glossary of Abbreviations

ADS	Audio distribution services
AIP	Administered incentive pricing
BEIRG	British Entertainment Industry Radio Group
BIS	Department for Business, Innovation and Skills
CAA	Civil Aviation Authority
CSR	Coastal-station radio
CTCSS	Continuous Tone-Controlled Signalling System
DCS	Digitally Coded Squelch
DFS	Dynamic frequency selection
DSO	Digital switchover
DTT	Digital terrestrial television
E&PSS	Emergency and public-safety services
EHF	Extremely High Frequency
EIRP	Equivalent isotropically radiated power
ERP	Effective Radiated Power
FIFA	Fédération Internationale de Football Association
FSS	Fixed satellite service
GHz	Gigahertz
GPS	Global Positioning System
HD	High definition
IBC	International Broadcast Centre
IEM	In-ear monitor

IOC	International Olympic Committee
IR	Interface Requirement
JTIDS	Joint Tactical Information Distribution System
kHz	Kilohertz
LOCOG	London Organising Committee of the Olympic Games and Paralympic Games Limited
MCA	Maritime and Coastguard Agency
MHz	Megahertz
MNO	Mobile-network operator
MOD	Ministry of Defence
MPC	Main Press Centre
MSS	Mobile satellite services
mW	Milliwatt
NOC	National Olympic committee
OB	Outside broadcast
OBS	Olympic Broadcasting Services
ODA	Olympic Delivery Authority
PES	Permanent earth station
PMR	Private mobile radio
PMSE	Programme-making and special events
PSSPG	Public Safety Spectrum Policy Group
RHB	Rights-holding broadcaster
RNSS	Radionavigation satellite services
SHF	Super High Frequency
SIDH	System Identification for Home System

SPGOG	Spectrum Planning Group for the Olympic Games and Paralympic Games
SRD	Short-range device
S-RSL	Short-term restricted-service licence
TES	Transportable earth station
TETRA	Terrestrial Trunked Radio
TPC	Transmitter power control
UHF	Ultra High Frequency
UKSSC	Cabinet Official Committee on UK Spectrum Strategy
UEFA	Union of European Football Associations
VANOC	Vancouver Organising Committee for the 2010 Olympic and Paralympic Winter Games
W	Watt
WCATV	Wireless CATV
WLAN	Wireless local-area network