



# The Spectrum Plan for the London 2012 Games

Statement

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# Contents

<b>Section</b>		<b>Page</b>
1	Executive Summary	1
2	Introduction	6
3	Spectrum for the London 2012 Games: overall approach	8
4	The Spectrum Plan: detailed arrangements	12
5	Operations and Licensing	36
<b>Annex</b>		<b>Page</b>
1	Government Guarantees and Ofcom's responsibilities for the London 2012 Games	42
2	Summary of Responses	47
3	Impact Assessment	95
4	Equality Impact Assessment	118
5	Glossary of Abbreviations	120

## Section 1

# Executive Summary

- 1.1 This Statement sets out our spectrum plan for wireless communications at the London 2012 Games. It also includes high-level approaches to licensing (authorisation) and interference management.
- 1.2 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 all key wireless services are kept free from harmful interference. Our consultation document of May 2009 set out a draft spectrum plan to meet the Government's spectrum guarantees to the International Olympic Committee (IOC)<sup>1</sup> with minimum disruption to other users.
- 1.3 At the same time, we recognise and acknowledge the importance of 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 because of the unique nature of the London 2012 Games, but not covered by the guarantees, are met and coordinated with day-to-day spectrum uses to the greatest extent possible.
- 1.4 We plan to award spectrum in the next year or so to a band manager with obligations to programme-making and special events (PMSE) users<sup>2</sup>. We have already indicated that we will need access to some of the spectrum to be awarded to meet the needs of the London 2012 Games. Applicants for the licence will need to take account of this along with any requirements imposed in the licence to ensure efficient coordination between shared use of the same spectrum.

## Consultation conclusions

- 1.5 We consulted on a draft spectrum plan on 27 May 2009<sup>3</sup>. Overall, respondents to the consultation were broadly supportive of our assumptions and of our planned approach to spectrum management for the London 2012 Games.
- 1.6 Respondents to the consultation made useful points and suggestions, which we have taken into account in publishing this revised spectrum plan. These will help us ensure that we will meet the needs of the guaranteed users at the London 2012 Games. We identify the changes in the body of the document, including our seeking access to an additional band for wireless cameras in the 2000 MHz to 4000 MHz range and clarification of the channels that will be available for wireless microphones and in-ear monitors (IEMs).
- 1.7 We also recognise that some details of the spectrum plan must continue to evolve over time as details of demand and supply change for each of the London 2012 Games venues.

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<sup>1</sup> See Annex 1.

<sup>2</sup> [www.ofcom.org.uk/consult/condocs/bandmgr/condoc.pdf](http://www.ofcom.org.uk/consult/condocs/bandmgr/condoc.pdf).

<sup>3</sup> <http://www.ofcom.org.uk/consult/condocs/london2012/>

## Spectrum supply

- 1.8 The sources of spectrum identified in the consultation continue to be available. Several respondents stressed the importance of London 2012 Games spectrum users being able to access all of these bands in order to ensure there is enough capacity: Ofcom agrees with this view. Further information is provided in our Statement on some bands that were not considered in the draft plan namely 385–399.9 MHz, 406.1–430 MHz and 3400–3600 MHz.
- 1.9 The Government's Digital Britain Final Report, published on 16 June 2009, mentioned two bands relevant to the London 2012 Games spectrum plan: 2600 MHz and 800 MHz. The proposals and their timing do not mean that Ofcom will need to change the approach to these bands set out in the consultation paper, but we may need to adapt the Olympics spectrum plan as the position becomes clearer.

## Meeting spectrum demand

### Private Mobile Radio, Talkback and Telemetry

- 1.10 Most demand for private mobile radio (PMR) will be met by the networks being built for the London Organising Committee of the Olympic Games and Paralympic Games (LOCOG) or extended for the emergency and public safety services (E&PSS). Demand outside these networks will be met from spectrum in the normal bands for PMR, talkback and telemetry. Ofcom will work closely with stakeholders to ensure the spectrum is available in the range 430 MHz to 478 MHz to meet these needs. However, it is our expectation that where requirements can be met from the LOCOG network stakeholders will adopt this solution.

### Wireless microphones and in-ear monitors

- 1.11 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, should be available for the London 2012 Games. As we said in the consultation, even modest improvements in the efficiency with which this spectrum is used compared to normal practice (e.g. as achieved during the London stages of the 2007 Tour de France) would ensure the peak demand of the Opening and Closing Ceremonies could be met with the spectrum that will be available.
- 1.12 Our assumption that sufficient spectrum would be available for wireless microphones and IEMs was based on our knowledge of available technologies and the density with which wireless microphones and IEMs can be deployed. Some respondents supported this assumption; others contested it. We will conduct further technical investigations to test and confirm our assumptions about what will be feasible. In the meantime we remain confident that the spectrum available will be adequate to meet peak demand for wireless microphones and IEMs. Except for some channels between Channels 22 and 30, the interleaved spectrum and 600 MHz band will be available for wireless microphones and IEMs as will Channels 42 and 68.

### Wireless cameras

- 1.13 In our consultation we suggested that there would be a high level of demand for spectrum for wireless cameras at the London 2012 Games. The spectrum plan identified capacity that could be made available by obtaining access to spectrum

from UK public sector bodies – notably the Ministry of Defence (MOD) and the Civil Aviation Authority (CAA) – and these bodies have committed to make some of the spectrum they hold available for temporary use for the London 2012 Games subject to necessary arrangements to ensure that essential defence and safety of life services are protected. Ofcom is also working with the Maritime and Coastguard Agency (MCA) to make available capacity in spectrum used for maritime services.

- 1.14 The preference of most respondents is for capacity between 2000 MHz and 4000 MHz; but to meet the highest level of likely demand Ofcom will make spectrum at 7000 MHz, 10 GHz and above available for wireless cameras. Ofcom believes that the demand for spectrum for wireless cameras at frequencies commonly used by broadcasters and for which equipment is readily available – i.e. 2000 MHz to 4000 MHz, and 7000 MHz – can be met. We will continue to work closely with broadcasters and manufacturers to encourage the use of high frequencies (e.g. frequencies above 7000 MHz) and will make higher-frequency spectrum available to those who are willing and able to use it.
- 1.15 The 3400-3600 MHz<sup>4</sup> band was not included in the consultation because it forms part of the MOD's Defence Spectrum Strategy<sup>5</sup>. Ofcom thinks that access to this band will be very important to meeting the demand for spectrum in the 2000 to 4000 MHz range for wireless cameras for the London 2012 Games. The MOD has said that it will release some spectrum from within the band by September 2010. Our spectrum plan does not change the MOD's Defence Spectrum Strategy, but it may be necessary to acquire spectrum released by the MOD before the London 2012 Games commences from the market to ensure the availability of spectrum for the London 2012 Games.

## Licensing

- 1.16 There was general agreement with Ofcom's proposal to establish special licensing arrangements for users covered by the Government's spectrum guarantees and to receive such applications through the on-line Rate Card system that will be operated by LOCOG. Ofcom confirms that special licensing arrangements will be established for the London 2012 Games and applications from users covered by the guarantees will be received through the LOCOG Rate Card system.
- 1.17 Respondents to the consultation made important observations about the need for proper provision of licensing arrangements for both Olympic Family members and other stakeholders. They also noted that such arrangements should avoid the inconvenience and confusion that could arise from requiring stakeholders to seek spectrum authorisation from a number of different sources. Dealing with these issues will require effective cooperation between Ofcom and the new band manager with obligations to PMSE users,<sup>6</sup> which will replace our current licensing arrangements for PMSE and about the arrangements for which we have recently consulted.
- 1.18 Respondents to the most recent consultation on proposals for the band manager with obligations to PMSE users, which closed on 7 September 2009<sup>7</sup>, have provided valuable input on licensing issues for the London 2012 Games. Until we have fully considered both sets of responses we believe it inappropriate to reach a definitive

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<sup>4</sup> See: [http://www.ofcom.org.uk/consult/condocs/3\\_4ghz/](http://www.ofcom.org.uk/consult/condocs/3_4ghz/)

<sup>5</sup> [http://www.mod.uk/NR/rdonlyres/40622FC9-DC7B-40FC-B48A-90408F6F7676/0/spectrumstatement\\_051208.pdf](http://www.mod.uk/NR/rdonlyres/40622FC9-DC7B-40FC-B48A-90408F6F7676/0/spectrumstatement_051208.pdf)

<sup>6</sup> <http://www.ofcom.org.uk/consult/condocs/bandmgr/condoc.pdf>

<sup>7</sup> <http://www.ofcom.org.uk/consult/condocs/bandmanager09/>

view about licensing arrangements for the London 2012 Games for all stakeholders. We will set out our conclusions on the licensing arrangements for the London 2012 Games in due course.

## **Satellite News Gathering**

- 1.19 We expect the demand for satellite news gathering (SNG) to be high at London 2012 Games venues. In the UK there are some geographic restrictions on SNG use in close proximity to airports and other sensitive sites, although the impact of such restrictions on SNG use within Olympic venues is likely to be minimal. It is our normal practice to require that each SNG terminal deployment is cleared and authorised by Ofcom and an online tool is provided for this purpose. However, for the London 2012 Games we plan to pre-coordinate 11 GHz and 14 GHz SNG operations at Olympic venues in order to streamline our licensing processes and support the very rapid deployment of SNG within London 2012 Games venues. Licences to enable Olympic Family members to deploy SNG within London 2012 Games venues will be available through the LOCOG Rate Card in advance of the London 2012 Games.

## **Interference management and enforcement**

### **Pre-testing, tagging and test events programmes**

- 1.20 Mitigating the risk of harmful radio interference is a key component of our plans for the London 2012 Games.
- 1.21 We agree with the view expressed in response to the consultation that the vast majority of interference is not caused deliberately, but arises through non-conformity with technical standards or technical licence conditions and that because of this it is vitally important to implement an effective equipment testing service ahead of the London 2012 Games. For hand-portable equipment, the best way to deliver a pre-testing and tagging service is by means of well equipped, on-site laboratories, with on-site visits to inspect key radio installations.

### **Deployment of interference management engineers**

- 1.22 We believe that it is important to maintain a presence throughout the London 2012 Games in case we are called upon to deal with cases of harmful radio interference. Venue-based offices for our field force of interference management engineers and their equipment for carrying out interference resolution will be valuable in reducing response times to a minimum.

### **Monitoring**

- 1.23 We are examining the feasibility of establishing a network of sensors both within key London 2012 Games venues and outside these venues to allow us to rapidly locate the position of any interfering radio signal sources. While establishing the final location of any interfering radio signal sources will always require an experienced spectrum engineer, we hope that a position location network will allow us to significantly reduce the time required to resolve any radio interference issues that may arise.

## Next Steps

- 1.24 We believe that the plan delivers the spectrum which will be required to meet the Government's guarantees. We do not expect to need to source significant further spectrum for the London 2012 Games; and we will base our detailed planning for licensing and operations on the plan in this Statement. Some details of the spectrum plan for the London 2012 Games may change over time as demand becomes clearer and the availability of spectrum changes. However, our ability to accommodate new demands for spectrum not identified in this plan is very limited.
- 1.25 The technical work has started to clarify the detail of the access that London 2012 Games users will have to spectrum, including at a venue-specific level.
- 1.26 Further information on our next steps is set out in section 2.

## UK Government endorsement

- 1.27 The Cabinet Official Committee on UK Spectrum Strategy (UKSSC) has asked us to publish the following endorsement of this Statement on behalf of the Government:

"UKSSC has been fully consulted with regard to this Statement. It endorses the content and the spectrum plan laid out by Ofcom and welcomes the steps it proposes to take to meet the spectrum guarantees given by the Government in support of the London 2012 Games."

## 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. These will take place between 27 July and 9 September 2012.
- 2.2 The Olympic and Paralympic Games are the world's largest sporting events, with around 14,500 athletes from over 200 nations. They attract around 20,000 accredited media and millions of spectators. The London 2012 Games are also expected to involve up to 70,000 volunteers to assist with their organisation.
- 2.3 A new Olympic Park is being built on a 500-acre site in the Lower Lea Valley. Many venues in London and around the UK will also host events. There will be some 25 venues in London, with a further 10 across the UK. Numerous other non-competition venues for the operation of the London 2012 Games will include the International Broadcast Centre (IBC), the Main Press Centre (MPC), the Technology Operations Centre, the Olympic and Paralympic Villages, Media Villages, logistics depots and transport centres. A number of venues will host cultural events connected with the London 2012 Games.
- 2.4 As well as the London 2012 Games themselves, test events will take place in 2011 and 2012 at both competition and non-competition venues.
- 2.5 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).
- 2.6 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 IOC in support of London's bid for the Games<sup>8</sup>. 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<sup>9</sup>.
- 2.7 At the same time, we recognise and acknowledge the importance of 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 and other related events and celebrations (see paragraphs 4.37 and 4.38) are met and coordinated with day-to-day spectrum uses so far as possible.

## Discussion and consultation

- 2.8 In 2007 we published a discussion document on our approach to spectrum planning for the London 2012 Games. This discussion document set out our analysis at that

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<sup>8</sup> See Annex 1.

<sup>9</sup> See Annex 1, para. A1.4

time of the spectrum requirements of the London 2012 Games and explored the possibility of using spectrum more efficiently to meet those requirements. It sought information and views to aid our understanding of these factors and so assist us in constructing a draft spectrum plan. Non-confidential responses, as well as a summary<sup>10</sup> are available from our website.

- 2.9 Taking responses to the discussion document and other information into account we published in May 2009 a draft spectrum plan for the London 2012 Games to meet the Government's spectrum guarantees with minimum disruption to other users. The consultation closed on 5 August 2009. We received 28 responses. 20 of these have been published on our website<sup>11</sup> and 3 are confidential. Five informal responses were also received.

## Next steps

- 2.10 We will continue to develop this spectrum plan as further information (e.g. about demand) becomes available. We will also continue to refine our assumptions about spectrum quality and the constraints on frequency re-use; and to monitor the spectrum for interference. We expect to publish an update to the spectrum plan, including venue-specific plans where necessary, in the second half of 2010.

## Purpose and structure of this document

- 2.11 In the light of the responses received to the consultation, this document sets out:
- Our conclusions about what spectrum will be made available for wireless communications including our overall approach and our basic assumptions about specific wireless applications (section 3).
  - The spectrum plan – detailed arrangements (section 4)
  - Our proposed high-level approaches on operational and licensing matters (section 5).
  - The Government guarantees and Ofcom's responsibilities for the London 2012 Games (in Annex 1).
  - A summary of the responses to our proposals and the draft spectrum plan (in Annex 2)
  - An Impact Assessment of Ofcom's plans as a whole (Annex 3).
  - An Equality Impact Assessment (Annex 4)
  - A glossary of abbreviations (Annex 5).

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<sup>10</sup> <http://www.ofcom.org.uk/consult/condocs/london2012/>

<sup>11</sup> <http://www.ofcom.org.uk/consult/condocs/london2012/responses/>

## Section 3

# Spectrum for the London 2012 Games: overall approach

- 3.1 This section sets out the overall approach to the spectrum plan to meet the Government's spectrum guarantees with minimum disruption to other (day-to-day) users. Some details of the spectrum plan for the London 2012 Games may change over time as demand becomes clearer and the availability of spectrum changes.
- 3.2 In the May 2009 consultation document we proposed the draft plan for the frequency bands which we believed adequate to meet the demand from guaranteed users. Responses to the consultation document indicate that, in general, the plan we proposed will meet the expected needs of the guaranteed users. We therefore will use the spectrum plan set out in the consultation document as the basis for the spectrum plan for the London 2012 Games.
- 3.3 In our general approach 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 existing users from spectrum for the duration of the London 2012 Games requirement.
- 3.4 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 Some of the extra demand for the London 2012 Games will be met from spectrum held or managed by UK public sector bodies such as the MOD and made available by them to London 2012 Games-related users. We expect that spectrum to be returned to UK public sector bodies after the London 2012 Games requirement has ceased.

## Demand

- 3.6 The overall approach proposed by Ofcom to the assessment of demand was broadly supported by the respondents. Using a combination of top-down and bottom-up approaches and modelling to estimate demand is likely to provide the most accurate possible result, recognising that the pressure on wireless resources is on an upward trend and that users' estimates of the capacity they require will evolve as their plans for the London 2012 Games become clearer.

## Private Mobile Radio, Talkback and Telemetry

- 3.7 The demand for spectrum for the LOCOG network and for the E&PSS network is constrained by their use of Terrestrial Trunked Radio (TETRA) technology, which is designed to use specific bands. Their spectrum demand is therefore concentrated in the range 385-430 MHz. Ofcom is sourcing spectrum from within this frequency

range through existing allocation and assignment processes and from public sector bodies such as the MOD.

- 3.8 Demand outside these networks will be met from spectrum in the normal bands for PMR, talkback and telemetry. Ofcom will work closely with stakeholders to ensure the spectrum is available in the range 430-440 and 450-470 MHz to meet any such needs.

### **Wireless microphones**

- 3.9 The spectrum needed for wireless microphones is primarily in UHF Bands IV and V and there will be good availability in these bands as a result of the closure of analogue TV transmissions in London before the London 2012 Games start. Ofcom is confident that the spectrum included in the plan for wireless microphones, including UHF Bands IV and V will be adequate to meet peak demand. Some doubts have been expressed about the precise level of utilisation that can be achieved. Ofcom will commission further technical work to test and confirm our assumptions about demand for spectrum for wireless microphones and In Ear Monitors (IEMs).

### **Wireless cameras (including High Definition)**

- 3.10 The responses to our consultation confirm that the demand for frequencies for wireless cameras is concentrated in the bands below 4000 MHz.
- 3.11 In the consultation we said that there would be a high level of demand for spectrum for wireless cameras at the London 2012 Games. The draft spectrum plan identified capacity that could be made available by obtaining access to spectrum from UK public sector bodies – notably the MOD, the CAA and the MCA. Much of this spectrum is between 2000 MHz and 4000 MHz; but to meet the highest level of likely demand Ofcom said it would also make available spectrum at 7000 MHz, 10 GHz and above.
- 3.12 Several respondents, including SiSLive, the BBC, JFMG, LOCOG and Olympic Broadcasting Services (OBS) expressed their preference to use spectrum in bands below 4000 MHz, because of the propagation characteristics of these bands (especially valuable to cover events taking place over wide areas, such as the marathon, rowing, and sailing) and the fact that broadcasters already have (or can readily hire) equipment that works in these bands. Cameras using 7000 MHz are available and respondents acknowledged that these frequencies would be acceptable for some relatively short-distance, in-stadium applications.
- 3.13 An allowance for growth in high definition (HD) technology (e.g. point-of-view cameras) has been made in our plan.
- 3.14 Ofcom believes that we can satisfy demand for spectrum for wireless cameras (including HD technologies) at frequencies commonly used by broadcasters and for which equipment is readily available – i.e. 2000 MHz to 4000 MHz and 7000 MHz. We will continue to work closely with broadcasters and manufacturers to encourage the use of higher frequencies and will make higher-frequency spectrum available to those who are willing and able to use it.
- 3.15 Spectrum within the bands 2700-3100 and 3100-3400 MHz will be made available for wireless cameras at the London 2012 Games and Ofcom considers that access to the 3400-3600 MHz band, which is managed by the MOD and forms part of the MOD's holdings and its spectrum reform programme, is a high priority, but

assignments in all these bands for wireless cameras will be subject to some technical conditions and geographic restrictions for interference management reasons. For bands that are managed by the MOD or NATO the details of the spectrum that will be made available (and the technical conditions and restrictions of access to it) will be included in a Memorandum of Understanding (MoU) to which Ofcom and the MOD are committed.

- 3.16 Ofcom will prioritise the order in which the bands for wireless cameras will be made available. Although there is evidence of demand for access to the 2700-3100 MHz range this band is used by civil and military radar systems. As a proportion of the radar use is mobile and ship-borne and shared with radar for airspace management<sup>12</sup>, any interference management arrangement is likely to be complex particularly for the sailing event. For this reason Ofcom will consider access for wireless cameras in the other bands identified before considering assignments in the 2700-3100 MHz range.
- 3.17 The BBC requested in its response that Ofcom should reserve the 2600 MHz band for wireless camera use during the London 2012 Games. The Government's Digital Britain Final Report envisages this band being awarded to new users at an early date; and it appears that the other bands we have identified will be adequate to meet expected demand for wireless camera spectrum. Ofcom therefore does not expect to need to reserve it for wireless camera use in 2012. We will, however, keep this position under review.

## Supply

- 3.18 In the light of responses to our consultation Ofcom believes that the bands identified in the consultation for use at the London 2012 Games will be adequate for the identified needs. The spectrum required for the London 2012 Games will be made available from civil spectrum, public sector spectrum holdings and licence exempt spectrum.

## Civil spectrum

- 3.19 To some extent all of the wireless services required by the London 2012 Games operate on a day-to-day basis in the UK. We have in the past (e.g. for the London stages of the 2007 Tour de France) negotiated the temporary use of civil spectrum that has already been licensed and some of the spectrum requirement for the LOCOG network for the London 2012 Games has already been sourced from the civil spectrum market. However, under paragraph 8(5) of Schedule 1 to the Wireless Telegraphy Act 2006<sup>13</sup>, we 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. As noted in Annex 1 paragraph A1.5, 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. Ofcom would endeavour to explore all options to accommodate both Olympic and non-Olympic use before revoking or varying licences.
- 3.20 To maximise the supply of spectrum for the London 2012 Games we have announced our intention to defer the start date for rights to use the UK's digital

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<sup>12</sup> The CAA preparations for the London Olympics and Paralympics 2012  
<http://www.caa.co.uk/default.aspx?catid=1908&pagetype=90>

<sup>13</sup> [http://www.opsi.gov.uk/acts/acts2006/pdf/ukpga\\_20060036\\_en.pdf](http://www.opsi.gov.uk/acts/acts2006/pdf/ukpga_20060036_en.pdf)

dividend – the spectrum being freed up for new uses by the switchover from analogue to digital terrestrial television - in London until after the end of the London 2012 Games.

### **Public sector spectrum holdings**

3.21 Significant amounts of spectrum are managed by UK public sector bodies. In particular, the MOD, the CAA and the MCA manage spectrum essential for defence, security and safety purposes that could be used on a temporary basis for the London 2012 Games, subject to coordination and agreement.

3.22 The Government has already indicated in its Forward Look 2009<sup>14</sup> that:

“Ofcom’s objective is to ensure that the UK meets its commitment to make spectrum available for the London 2012 Games at minimum cost to UK citizens and consumers. It is therefore intended that the requirements of the London 2012 Games will wherever possible be met from within bands managed by the public sector, notably the MOD.”

3.23 This must be seen in the context of the Government’s commitment to reforming public sector spectrum management, including introducing spectrum trading to enable public sector bodies to interact with the market, as also set out in Forward Look 2009. The Government has said that it will adjust the timing of the release of spectrum bands included within public sector spectrum reform that are required to meet its guarantees, where spectrum cannot be reasonably sourced from the market.

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<sup>14</sup> <http://www.berr.gov.uk/files/filee46420.pdf>

## Section 4

# The Spectrum Plan: detailed arrangements

4.1 The following sections set out the details of our Spectrum Plan. This takes account of the comments received on the consultation document.

## Private Mobile Radio

4.2 This section sets out our plan for spectrum for PMR – land radio and maritime radio.

### Land radio

4.3 LOCOG has contracted with Airwave to provide it with land radio services. Spectrum for this is being secured through existing allocation and assignment processes and by agreements (including Recognised Spectrum Access and trading) with public sector bodies. The LOCOG network is expected to cover all competition and other key operational venues as well as the Olympic Route Network (ORN): it is expected to meet the needs of the great majority of Olympic Family users with requirements for PMR. The spectrum used for this will be met from the 385-399.9 MHz and 406.1-430 MHz bands. Spectrum from within the 406.1-430 MHz range will be used for E&PSS. It is our expectation that where requirements can be met from the LOCOG network stakeholders will adopt this solution.

4.4 The needs of users covered by the Government's spectrum guarantees who are not able to make use of the LOCOG network will be met from bands used for PMR, including 137-173 MHz, 430-440 MHz and 450-470 MHz, which is heavily congested in the London area. These 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 MHz to 478 MHz.

4.5 The 430-440 MHz band is managed by the MOD and is used by Radio Amateurs on a secondary basis. Ofcom notes RAYNET's response, which pointed out that this band is used to support 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 exceeds our ability to meet it from our preferred bands.

4.6 If demand cannot be met from the market it may be necessary to revoke or temporarily vary some licences to allow spectrum use for the London 2012 Games. We will work closely with stakeholders to explore all options to accommodate both Games and non-Games use prior to taking such action.

4.7 The bands we have identified for land mobile, handheld communications and talkback are set out in tables 1 and 2 below.

**Table 1. Bands identified for land radio and handheld communications (MHz)**

68.08125-87.49375	137-173	193.2-207.5	385-399.9	406.1-410 & 414-420	424-425 & 429-430	410-412 & 420-422	412-414 & 422-424
430-440	446.00625 - 446.09375	450-470	470-478	494-502	870-872	915-917	

**Table 2. Spectrum Bands Identified for talkback (MHz)**

430-440	450-470	470-478 (Channel 21)	494-502 (Channel 24)
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- 4.8 The band 385-399.9 MHz is managed by NATO and the MOD. The MOD has said that its strategy for Defence spectrum<sup>15</sup> should be read in the context of the UK's upcoming spectrum commitments for the London 2012 Games. The implications for the MOD's strategy<sup>16</sup> will be taken into consideration, but in any event the MOD anticipates that any spectrum it provides for use for the London 2012 Games will be returned after they have concluded.
- 4.9 The London 2012 Games may require spectrum from within the range 406.1-410 MHz that is managed by the MOD. Ofcom has noted the request from the MCA to protect the Cospas-Sarsat satellite network that operates in 406.0-406.1 MHz. Ofcom has undertaken a review of the protection requirements for the Cospas-Sarsat network and accordingly proposes that no assignments will be made for the London 2012 Games above 399.9 MHz and below 407.0 MHz. The MOD intends that defence use of the 406.1-410 MHz band will continue.

### CTCSS tones and DCS codes

- 4.10 We consider that a requirement to use CTCSS tones/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

- 4.11 PMR 446<sup>17</sup> will be able to use eight 12.5 kHz simplex channels anywhere in the UK on a licence-exempt basis, although there may be additional coordination requirements within London 2012 Games venues and it may not be allowed within the Olympic venues. Further information is given in Section 5. The channel centre frequencies are set out in table 3 below.

<sup>15</sup> [http://www.mod.uk/NR/rdonlyres/40622FC9-DC7B-40FC-B48A-90408F6F7676/0/spectrumStatement\\_051208.pdf](http://www.mod.uk/NR/rdonlyres/40622FC9-DC7B-40FC-B48A-90408F6F7676/0/spectrumStatement_051208.pdf)

<sup>16</sup> [http://www.mod.uk/NR/rdonlyres/40622FC9-DC7B-40FC-B48A-90408F6F7676/0/spectrumStatement\\_051208.pdf](http://www.mod.uk/NR/rdonlyres/40622FC9-DC7B-40FC-B48A-90408F6F7676/0/spectrumStatement_051208.pdf)

<sup>17</sup> A higher power version with base stations is sometimes referred to in the United States of America as "Family Radio Service".

**Table 3. Centre frequencies for PMR446 channels (MHz)**

446.00625	446.01875	446.03125	446.04375
446.05625	446.06875	446.08125	446.09375

4.12 PMR 446 equipment must:

- be hand portable;
- have an integral antenna;
- have a maximum effective radiated power of 500 mW; and
- comply with European Telecommunications Standard ETS 300 296 if placed on the market before 8 April 2001 or Interface Requirement (IR) 2009<sup>18</sup> if placed on the market after this date.

4.13 Other equipment that can use different frequencies, including short-range business-radio equipment capable of operating at 461 MHz, may not be used for PMR 446.

4.14 As with all licence exempt equipment, the use of PMR 446 is not protected from harmful interference. This may occur if there are many other users locally, as may be the case during the London 2012 Games. Problems may be reduced by changing channel or by using use CTCSS tones/DCS codes.

4.15 In section 5 to this document 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 the detail of these arrangements and will publish details, including how they will relate to PMR 446, in due course.

### **Maritime radio**

4.16 Maritime radio may be used to support the sailing events at Weymouth/Portland. Further meetings of the maritime subgroup<sup>19</sup> of the Spectrum Planning Group for the Olympic Games (SPGOG – see Annex 1) will take place in 2009/10 to refine the estimated demand and the arrangements for the sailing events at Weymouth/Portland in the light of test events and Ofcom will develop a venue specific spectrum plan for the sailing events.

4.17 There is currently unused capacity within the spectrum used for maritime radio in the Weymouth/Portland area, although this could become scarce between now and the London 2012 Games. Ofcom's spectrum plan for maritime use, which may be revised in the light of further information, will make use of some of this unused capacity and 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 with France.

4.18 The dual-frequency and single-frequency maritime channels that may be made available are given in tables 4 and 5 respectively, below.

<sup>18</sup> [www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/ir2009.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/ir2009.pdf).

<sup>19</sup> 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.

**Table 4. Dual-frequency maritime channels (25 kHz channel spacing)**

<b>CSR<sup>20</sup> International Dual-frequency channels (MHz)</b>	
<b>Mobile (Ship)</b>	<b>Base (Coast)</b>
157.350	161.950
157.400	162.000

<b>CSR International Dual-frequency channels that may also be split for single-frequency working where appropriate (MHz)</b>	
<b>Mobile (Ship)</b>	<b>Base (Coast)</b>
156.025	160.625
156.075	160.675
156.100	160.700
156.150	160.750
156.200	160.800
156.250	160.850
156.275	160.875
156.325	160.925
156.350	160.950
156.900	161.500
156.925	161.525
156.950	161.550
156.975	161.575
157.000	161.600
157.050	161.650
157.075	161.675
157.125	161.725
157.175	161.775
157.250	161.850
157.300	161.900

<b>CSR UK Dual-frequency channels that may also be split for single-frequency working where appropriate (MHz)</b>	
<b>Mobile (Ship)</b>	<b>Base (Coast)</b>
157.475	162.075
157.525	162.125
157.650	162.250
157.700	162.300
158.025	162.625
158.050	162.650
158.100	162.700
158.125	162.725

<sup>20</sup> Coast Station Radio

158.200	162.800
158.225	162.825
158.250	162.850
158.350	162.950
158.400	163.000

<b>CSR UK Dual-frequency channels but where only one leg as indicated below may be used - (single frequency) (MHz)</b>	
<b>Mobile (Ship)</b>	<b>Base (Coast)</b>
157.600	157.600
158.000	158.000
158.175	158.175
158.300	158.300
162.100	162.100
162.400	162.400
162.500	162.500
162.550	162.550
162.675	162.675
162.750	162.750

**Table 5. Single-frequency maritime channel frequencies (25 kHz channel spacing)**

<b>CSR International (Single-frequency) channels (MHz)</b>	
<b>Mobile (Ship)</b>	<b>Base (Coast)</b>
156.750	156.750
156.775	156.775
156.825	156.825
156.850	156.850
157.375	157.375
157.425	157.425

<b>CSR UK (Single-frequency) channels (MHz)</b>	
<b>Mobile (Ship)</b>	<b>Base (Coast)</b>
161.300	161.300
161.350	161.350
161.375	161.375
161.450	161.450
161.475	161.475

- 4.19 The use of these channels will be constrained by some planning and operational criteria, 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

- 4.20 To maximise the supply of spectrum for wireless microphones and IEMs for the London 2012 Games, we will make spectrum from the digital dividend available. We will therefore defer the start date for rights to use this spectrum in London until the London 2012 Games have concluded.
- 4.21 London will switch over from analogue to digital terrestrial television in April 2012. From that point, the availability of channels in UHF Bands IV and V for wireless microphones and IEMs in the Olympic Park is expected to be as set out in table 6 below.
- 4.22 Ofcom will develop venue-specific arrangements to ensure that channels freed up by the digital switchover (DSO) are available for use for wireless microphones and IEMs at venues outside London. For the sailing events at Weymouth/Portland the DTT switchover for the West Country region has already taken place this year.
- 4.23 We will also consider the requirement for venue-specific plans for events such as the football matches:
- Manchester where Granada DSO is scheduled in Q4 2009;
  - Cardiff where Wales DSO is scheduled for Q1 2010;
  - Glasgow where STV Central DSO is scheduled for 2010/11;
  - Birmingham where Central DSO is scheduled for 2011<sup>21</sup>; and
  - Newcastle where Tyne Tees DSO is scheduled for 2012.
- 4.24 We anticipate that the spectrum requirements for individual football matches will be much lower (and also handled in relatively similar ways to the club matches that take place on a regular basis). DSO for all these areas is scheduled to take place well in advance of the Olympics, with the exception of Tyne Tees which will not switch until after the London 2012 Games.
- 4.25 Table 6 differs from the table published in the consultation. Ofcom can now confirm that the channels previously identified as available if held back from new uses will be held back and will therefore be available in 2012. Second, Channel 68 was not mentioned. This was an error in the table that we published in the consultation. Channel 68 is available for the London 2012 Games following DSO. Table 6 identifies those channels in the UHF Bands IV and V that will be available for wireless microphones and IEMs at the London 2012 Games.

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<sup>21</sup> Following the decision by Aston Villa to undertake major development work an alternative venue in the Midlands is being sought.

**Table 6 Availability of UHF Bands IV and V for wireless microphones and IEMs in the Olympic Park**

21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	

	Available
	Availability not yet decided
	Not available – proposed for land radio/talkback
	Not available – awarded for new use
	Not available – used for DTT

- 4.26 This means that some 39 channels (each of 8 MHz, totalling up to 312 MHz) will be available by holding back rights of new use of the spectrum that will comprise the UK's digital dividend until after DSO. It should be noted that 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.
- 4.27 Availability may be less at other London venues (e.g. the ExCeL Exhibition Centre and Greenwich) because of greater use by DTT, but the forecast requirement for wireless microphones and IEMs is significantly lower than at the Olympic Park.
- 4.28 In addition to the above, Channel 70, used for licence exempt equipment, will be available. Ofcom is aware that a large number (approximately 1500 according to information provided by MLEC UK Ltd) of wireless microphones used on the underground system throughout London for making station and platform announcements across the entire London Underground system use this channel. These wireless microphones operate within Channel 70, also on a licence exempt basis and are therefore unprotected from other un-licensed and licensed uses. We will investigate this matter further.
- 4.29 Our assumption that sufficient spectrum would be available for wireless microphones and IEMs was based on our knowledge of available technologies and the density with which they can be deployed. Some respondents (e.g. JFMG and OBS) supported this assumption; others (e.g. the British Entertainment Industry Radio Group - BEIRG) contested it. We will conduct further technical investigations to test and confirm our assumptions about what will be feasible. In the meantime we remain confident that the spectrum available will be adequate to meet peak demand for wireless microphones and IEMs.
- 4.30 In summary, we will make the bands set out in table 7 below available for wireless microphones and IEMs.

**Table 7. Bands available for wireless microphones and IEMs (MHz)**

191.6-210.1	494-862	863-865 <sup>22</sup>	1785-1800 <sup>23</sup>
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<sup>22</sup> On a licence exempt basis.

<sup>23</sup> Digital wireless microphones only.

## Talkback

- 4.31 Talkback is mainly used by broadcasters, allowing producers to give directions to production team members such as camera operators, reporters and presenters. Based on the experience of the Athens Games, we have forecast demand for 410 channels in the Olympic Park, 260 in the River Zone and 111 in the Central Zone. We will therefore make the bands set out in table 8 below available for talkback.
- 4.32 Talkback users already use duplex channels paired with a non-generic 4 MHz gap within 470-478 MHz. To minimise the impact on existing users we will make duplex channels available within 470-478 MHz (Channel 21) in the Olympic Park, within 494-502 MHz (Channel 24) in the Central Zone and within both bands in the River Zone.

**Table 8. Bands available for talkback (MHz)**

430-440 <sup>24</sup>	450-470	470-478 (Channel 21)	494-502 (Channel 24)
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## Audio Distribution Services

- 4.33 Audio distribution services (ADS) re-transmit material already prepared for public use. They cover events and other temporary purposes.
- 4.34 Spectrum for Live ADS will be available so that everyone, including blind and partially sighted people, will have equal access to the Games, including the Opening and Closing Ceremonies, torch relays and medal ceremonies. In order to plan for this we need LOCOG and the Olympic Delivery Authority (ODA) to define their requirement for Live ADS, including that needed for the cultural events.
- 4.35 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, subject to coordination with the MOD.

## Video links

- 4.36 Video links include both wireless cameras and point-to-point links. They are used by broadcasters for capturing and reporting live events and by closed-circuit television for security purposes.

### Wireless cameras

- 4.37 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.
- 4.38 We believe we will need to accommodate a peak of up to 75 wireless camera channels in simultaneous use. This is based on:
- a peak of 36 channels experienced at the Beijing Games;

<sup>24</sup> Subject to coordination with the MOD.

- the scope to reuse spectrum between London 2012 Games venues; and
  - a generous allowance for growth given how production values (e.g. point-of-view cameras) have taken advantage of developments in HD technology.
- 4.39 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.
- 4.40 Several respondents, including SiSLive, the BBC, JFMG, LOCOG, OBS and another respondent expressed their preference to use spectrum in bands below 4000 MHz, because of the propagation characteristics (especially valuable to cover events taking place over wide areas, such as the marathon, rowing, and sailing) and the fact that broadcasters already have (or can readily hire) equipment that works in these bands. Cameras using 7000 MHz are also available; and respondents acknowledged that these frequencies would be acceptable for some relatively short-distance, in-stadium applications.
- 4.41 On this basis Ofcom believes that we can satisfy demand for spectrum for wireless cameras at frequencies commonly used by broadcasters and for which equipment is readily available – i.e. 2000 MHz to 4000 MHz, and 7000 MHz. We will continue to work closely with broadcasters and manufacturers to encourage the use of high frequencies and will make higher-frequency spectrum available to those who are willing and able to use it.
- 4.42 The BBC requested in its response that Ofcom should reserve the 2600 MHz band for wireless camera use during the London 2012 Games. The Digital Britain Final Report envisages this band being awarded to new users at an early date; and it appears that other bands will be adequate to meet expected demand for wireless camera spectrum. Ofcom therefore does not expect to need to reserve it for wireless camera use in 2012. We will, however, keep this position under review.
- 4.43 Spectrum within the bands 2700-3100 and 3100-3400 MHz will be made available for wireless cameras at the London 2012 Games and Ofcom considers that access to the 3400-3600 MHz band, which is managed by the MOD and forms part of the MOD's holdings and its spectrum reform programme, is a high priority, but assignments in all these bands for wireless cameras will be subject to some technical conditions and geographic restrictions for interference management reasons. In particular:
- The 2700-3100 MHz band is shared by the CAA with the MOD and the MCA for radars and includes a requirement for radars operated by the Met Office. Ofcom will continue to work with these organisations to release capacity within this band.
  - The 3100-3400 MHz band is managed by NATO and used for essential military land, airborne and naval radars. Capacity within it will be made available for wireless cameras at the London 2012 Games, subject to certain technical constraints needed to protect NATO and MOD use of the band for defence applications.

- The 3400-3600 MHz band<sup>25</sup> was not included in the consultation because it forms part of the MOD's Defence Spectrum Strategy and is scheduled for release by the MOD before 2012. We now believe that access to the 3400-3600 MHz band is a high priority for wireless cameras in 2012, including airborne use of wireless cameras.

### Airborne use of wireless cameras

- 4.44 We said in the consultation that we anticipate airborne use of some channels to allow wireless camera coverage of wide-area events (e.g. the marathons). This may involve use of helicopters and/or aeroplanes. The altitude at which they operate means opportunities for spectrum reuse are greatly diminished and the possibility of interference increased, while the range of usable spectrum is itself limited because of the mobility of these links.
- 4.45 Because of these factors, we will limit the number of channels available for airborne use to:
- bands that are suited to airborne (wireless camera) use in the 1000 to 4000 MHz range;
  - bands where the effects of interference can be managed simply; and
  - comply with the conditions under which spectrum is made available to Ofcom e.g. where restrictions or conditions are placed on access to protect defence and safety services.
- 4.46 Based on the experience of the Beijing Games, we had forecast demand for three airborne wireless camera channels in simultaneous use. However OBS regard this as too little. A better estimate of demand for airborne wireless cameras is likely to emerge later this year when the results of the survey of the aviation sector's requirements is completed by the Department for Transport's Aviation Stakeholder Group, but additional spectrum for airborne wireless cameras may be available if spectrum from within the 3400 – 3600 MHz band becomes available.
- 4.47 In the light of these considerations, we will make spectrum within the bands set out in table 9 below available for wireless cameras. Also indicated is the number of 10 MHz channels in each band we currently think might be available in the Olympic Park during the London 2012 Games. These estimates are likely to change at the margin as we receive new information.

**Table 9. Bands and channels available for wireless cameras**

Band (MHz)	Possible channel availability	Notes
1300-1320	2	Subject to compatibility with aeronautical/maritime radar
1660-1670	1	
2025-2110	7	Current PMSE use. Airborne use allowed
2200-2300	9	
2483-2500	1	
2700-2720	2	Subject to compatibility with aeronautic/maritime/meteorological radar
2742-2772	3	

<sup>25</sup> [http://www.ofcom.org.uk/consult/condocs/3\\_4ghz/](http://www.ofcom.org.uk/consult/condocs/3_4ghz/)

Band (MHz)	Possible channel availability	Notes
2820-2850	3	
2870-2890	2	
2900-3100	14	
3100-3400	Up to 21	Subject to compatibility with military radar
3400-3600	12	Home Office (for heli-telly), civil (including PMSE) and MOD use. Airborne use allowed
3690-3920	23	Subject to coordination with fixed links and satellite services
3925-4009	8	
4010-4200	19	Subject to coordination with fixed links and satellite services; indoor use only
4400-4800	22	
5472-5588	11	
5682.5-5702.5	2	Airborne use allowed
5705-5725	2	
5732.5-5752.5	2	
5770-5790	2	Some airborne use allowed
5795-5815	2	
5900-7110	120	Subject to coordination with fixed links and satellite services
7110-7250	14	Airborne use allowed
7300-7350	5	
7360-7425	6	
8460-8500	4	
61000-61500	50	On a licence exempt basis

4.48 We do not believe it necessary to:

- make available spectrum at 2500-2690 MHz that we plan to award for new use in the near future;
- rely on spectrum at 2400 MHz and 5000 MHz available for licence exempt use by wireless local area networks (WLANs) though it could be used if desired;
- rely on EHF spectrum at 5000 MHz to 10 GHz, though it could be used if desired; and
- rely on SHF spectrum, though this, too, could be used if desired.

4.49 20 MHz channels are currently available within the 3400–3600 MHz band and Ofcom considers that access to the 3400-3600 MHz band for the London 2012 Games a high priority. We will create 20 MHz channels from two adjacent 10 MHz channels in other bands if necessary, but since creating 20 MHz channels from two adjacent 10 MHz channels could significantly reduce the number of wireless cameras that could use high-demand bands, our preference is to look first at the 5000 MHz to 10 GHz bands where we believe congestion is much less likely.

## Point-to-point links

- 4.50 Point-to-point links might be required to connect venues or to provide video signals to an outside-broadcast (OB) truck, for example. The need for this service has reduced over the years, while optical fibre is often used for backups and intra-venue links.
- 4.51 We foresee a requirement for point-to-point links for the London 2012 Games. Some could carry video signals from helicopter downlinks to the IBC, a production truck or a satellite uplink, as seen during the London stages of the 2007 Tour de France. Others could be required to support the sailing events at Weymouth/Portland and they have a role to play where it is impractical or prohibitively expensive to deploy fibre.
- 4.52 A specific forecast would not be helpful for spectrum planning purposes this far ahead of the London 2012 Games, not least because of the variation in required bandwidth and the scope for frequency reuse as a result of using highly directional antennas.
- 4.53 Where terrestrial point-to-point links can be planned in advance, we expect the spectrum requirements they generate to be met using the bands normally available for fixed links. In these circumstances the normal coordination procedures would apply. Olympic Family members will be able to apply for assignments for terrestrial point-to-point links using the Rate Card.
- 4.54 It may be more suitable for terrestrial point-to-point links deployed at short notice to use spectrum specifically proposed for wireless camera use to reduce the need for coordination with other users. If so, our preference will be to look first at the 5000 MHz to 10 GHz bands where we believe congestion is much less likely.
- 4.55 We will therefore make the bands set out in table 10 below available for terrestrial point-to-point links.

**Table 10. Bands available for point-to-point links**

5725-5850 MHz	7425-7900 MHz	10.3-10.36 GHz	10.6-10.68 GHz	12.75-13.25 GHz
14.5-15.35 GHz	17.7-18.45625 GHz	18.4625-18.7 GHz	18.7-19.46625 GHz	19.4705-19.7 GHz
22.0-23.6 GHz	24.25-26.5 GHz	31.0-31.3 GHz	31.5-31.8 GHz	37.0-39.5 GHz
51.4-52.6 GHz	55.78-59.0 GHz	64.0-66.0 GHz	71.125-75.825 GHz	81.125-85.875 GHz

- 4.56 Where bands are managed by MOD, their availability is subject to coordination.

## Other guaranteed services

- 4.57 This section sets out our assessment and proposals for other guaranteed services – satellite services, telemetry and telecommand and WLANs.

### Fixed satellite services

- 4.58 Fixed satellite services (FSS) use earth stations operating at known locations that transmit to and/or receive from satellites. At the London 2012 Games, FSS will be

used by broadcasters to carry video and audio feeds from 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), also known as satellite newsgathering terminals.

## PES

4.59 PES 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/Portland.

4.60 As PES are planned well in advance and at a known fixed location, 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 below.

**Table 11. Bands available for PES**

Band	Transmit frequencies (MHz)	Receive frequencies (MHz)	Notes
C	5850-7075	3600-4200	Shared with fixed services (all frequencies) and broadband wireless access (parts of 3600-4200 MHz in some locations)
Ku	12750-13250	10700-11700	Shared with fixed services (12.750-13.250 GHz); limited sharing 10.7-11.7 GHz. It should be noted that there are some pre-existing fixed service links operating at 11 GHz and these may impose constraints on fixed satellite service downlink operations – this will be captured in the pre-coordination exercise.  The fixed wireless service band at 10.7-11.7 GHz is a closed band i.e. no new fixed service assignments can be made. Ofcom will not authorise new fixed services assignments in the 10.7-11.7GHz band for the London 2012 Games.
	13750-14500	11700-12750	Shared with fixed services (14250-14500 MHz)
Ka	27500-27818.15	17700-19700	Shared with fixed services (17700-19700 MHz)
	28454.5-28826.5	17700-19700	
	29462.5-29500	17700-19700	
	29500-30000	19700-20200	

4.61 As PES share spectrum with other services, coordination and, in some cases, electromagnetic compatibility tests may be necessary before we can authorise use.

## TES

4.62 TES are transportable in nature, but transmit from a fixed known location at any one point in time.

- 4.63 We expect demand for TES to be high at London 2012 Games venues. In the UK there are some geographic restrictions on SNG use in close proximity to airports and other sensitive sites, although we anticipate that the impact of such restrictions on TES use within London 2012 Games venues is likely to be minimal. We expect the spectrum requirements generated by TES to be met from spectrum currently used for this type of application noting that spectrum access is mainly handled by commercial agreements with satellite operators, and availability is primarily dictated by the capacity on each satellite.
- 4.64 Authorisations are available in the bands shown in table 12 below.

**Table 12. Bands available for TES**

Band	Transmit frequencies (GHz)	Receive frequencies (GHz)	Notes
Ku	13.78-14.5	10.7-12.75	Shared with radiolocation services (13.78-14.0 GHz) and fixed services (14.25-14.5 GHz)

- 4.65 As TES share spectrum with other services it is our normal practice to require that each TES terminal deployed is cleared and authorised by Ofcom. An online tool is provided for this purpose. However, we plan to pre-coordinate 11 GHz and 14 GHz TES operation at London 2012 Games venues in order to streamline our licensing processes and support the very rapid deployment of TES within London 2012 Games venues. Any restrictions on the deployment of TES identified during pre-coordination will be notified to users well in advance of the London 2012 Games. Licences to enable Olympic Family members to deploy TES within London 2012 Games venues will be available through the LOCOG Rate Card in advance.
- 4.66 Pre-coordination should identify any constraints with respect to fixed services, the MOD and the CAA. When we make assessments we also will consider FSS Earth Station (ES) transmit interference into fixed service links. There is no need for an assessment of FSS interference into FSS downlinks at 11 GHz.
- 4.67 It should be noted that there are some pre-existing fixed service links operating at 11 GHz and these may impose constraints on FSS downlink operation – this will be captured in the pre-coordination exercise.
- 4.68 In order to ensure the maximum availability of Ku band links for Earth Stations Ofcom will not authorise fixed links in this band around London 2012 Games venues.
- 4.69 It should be noted that no coordination of the receive component of TES services takes place. As a consequence no protection is currently afforded to any signals received by TES terminals. Given the static nature of fixed services operating in spectrum shared with TES the risk of harmful interference is small. We nonetheless expect to conduct additional analysis to identify any risks to TES receivers to aid future planning of their use at London 2012 Games venues.
- 4.70 C-Band is not normally available for TES applications in the UK although some use may be possible at “planned” locations if the fixed transmission requirements are known. Ofcom will consider applications for C-Band TES use at London 2012 Games venues. We expect that such requests will be dealt with on a case-by-case basis so that the necessary detailed technical coordination with other users of the band can be carried out. We will endeavour to ensure that arrangements for C-Band TES are

as streamlined as possible. Applications for the use of C-Band TES within Olympic venues will be available through the LOCOG Rate Card in advance of the Games.

## Mobile satellite services

- 4.71 Mobile satellite services (MSS) operate globally through a number of geostationary and non-geostationary satellite constellations, normally with their service links in the range 1000 MHz to 3000 MHz. They support general consumer voice communications and broadband video and data transmissions. In addition, they provide communication links for defence and security services that are independent of terrestrial networks<sup>26</sup>.
- 4.72 Spectrum for MSS is already available with restrictions on certain locations only when absolutely necessary, both inside and outside the Olympic Park.
- 4.73 MSS terminals (excluding aircraft earth stations) are licence exempt. The available bands are set out in table 13 below.

**Table 13. Bands available for MSS**

Earth to space (MHz)	Space to Earth (MHz)	UK alternate use	Current operators	Notes
1518-1525	1670-1675	PMSE (limited)		Primary MSS; likely to be geostationary
1626.5-1660.5	1525-1559		Inmarsat, Thuraya, SkyTerra, Volna	Primary MSS; geostationary
1610-1626.5	2483.5-2500	PMSE (2483.5-2500 MHz)	Globalstar	Primary MSS; non-geostationary
1621.35-1626.5	1621.35-1626.5		Iridium	Secondary MSS; non-geostationary
1980-2010	2170-2200	PMSE (limited)	Two operators as probable candidates	Primary MSS

## Radionavigation satellite services

- 4.74 Radionavigation satellite services (RNSS) – commonly known as “sat nav” – 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 of people, goods and terminals and for timing and synchronisation.
- 4.75 LOCOG in its response stressed the heavy use of and reliance on GPS technologies for timing and other London 2012 Games purposes. Ofcom will reinforce through the relevant Government committee the importance of uninterrupted GPS service during the London 2012 Games.

<sup>26</sup> [www.cabinetoffice.gov.uk/ukresilience/preparedness/resilient\\_telecommunications/enhancing\\_catalogue.aspx](http://www.cabinetoffice.gov.uk/ukresilience/preparedness/resilient_telecommunications/enhancing_catalogue.aspx).

- 4.76 RNSS receivers are licence exempt. The available bands are set out in table 14 below.

**Table 14. Bands available for RNSS**

Space to Earth (MHz)	Notes
1215-1300	Non-geostationary
1559-1610	Non-geostationary

## Telemetry and telecommand

- 4.77 Telemetry and telecommand will be used at the London 2012 Games to control cameras, camera shutters and other equipment remotely and for localised data communications.
- 4.78 The use of telemetry and telecommand is increasing over time. Based on our understanding of past Games, we have forecast demand for critical services for 50 channels in the Olympic Park, 20 channels in the River and Central Zones, 10 channels in Weymouth/Portland and 20 channels distributed across other venues. This is greater than at the Athens Games.
- 4.79 A range of spectrum is currently available for telemetry and telecommand applications on a licence exempt basis. Some of the available bands are set out in table 15 below. Section 5 of this document highlights that, due to the high level of use of exempt spectrum anticipated at London 2012 Games venues, it might be necessary to introduce additional coordination arrangements for such equipment. We will publish details of any such arrangements and how they relate to telemetry and telecommand in due course.
- 4.80 Ofcom notes that in some cases PMR devices could be used to carry data and that this may often be the case for telemetry applications, which do not use licence exempt spectrum. We will make spectrum available for telemetry and telecommand on an exclusive basis within the Olympic Park as part of our venue-specific spectrum plan in the light of more details of the demand from users.
- 4.81 Ofcom will consider whether there is a requirement to use the primary and secondary allocations to the Amateur and Amateur-Satellite Service as we develop our venue-specific spectrum plans. We will continue to work closely with key stakeholders as we develop these plans.

**Table 15. Bands available for telemetry and telecommand on a licence exempt basis**

Band (MHz)	Reference standard
0.009-0.325	EN 302 195
169.4-169.475	EN 300 220
173.2-173.35	
433.05-434.79	
458.5-459.1	
869.4-869.65	
2445-2455	EN 300 440
24150-24250	EN 300 440

- 4.82 Details of other short range (low power) applications are given in IR 203027.
- 4.83 Although Bluetooth devices operating at 2400 MHz are increasingly being used, the possibility of harmful interference from WLANs and even from domestic microwave ovens means they may not be suitable for critical services. Spectrum at 430-470 MHz proposed for land radio and talkback may be better suited instead.

## Licence exempt spectrum

- 4.84 Spectrum for licence exempt equipment is identified by service category for the London 2012 Games in table 16 below. Further bands are available for Short Range Devices (SRDs). Further information on SRD bands can be found in the UK Frequency Allocation Table<sup>28</sup>. For detailed information on the regulations and technical usage please refer to the IR 203029.
- 4.85 Section 5 to this document highlights that, due to the anticipated high level of use of 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.
- 4.86 However, whatever arrangements Ofcom may decide to implement these are unlikely to entirely remove the risk of interference from other exempt technologies. For this reason we recommend that, wherever possible, Games-critical applications should avoid using licence exempt bands.

**Table 16. Spectrum for licence exempt equipment is identified by service category**

<b>Telemetry and telecommand</b>	00.009–0.325 MHz
	169.4–169.475 MHz
	173.2–173.35 MHz
	433.05–434.79 MHz
	458.5–459.1 MHz
	869.4–869.65 MHz
	2445–2455 MHz
	24150–24250 MHz
<b>Wireless microphones</b>	863-865 MHz
<b>Wireless cameras</b>	61–61.5 GHz

<sup>27</sup> [http://www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/IR2030final.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/IR2030final.pdf)

<sup>28</sup> See ANNEX B of the UK FAT: <http://www.ofcom.org.uk/radiocomms/isu/ukfat/>

<sup>29</sup> IR2030 can be found at: [http://www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/IR2030final.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/IR2030final.pdf)

## **Spectrum for remote camera shutter control**

- 4.87 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 press. Wireless adaptors generally use low power WLAN links either through wireless hotspots or to wireless enabled laptops. 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 un-licensed and licensed uses.
- 4.88 Section 5 to this document highlights that, due to the anticipated high level of use of 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.

## **Wireless Local Area Networks**

- 4.89 WLANs are also known as Wi-Fi and hot spots.
- 4.90 WLANs will be provided by LOCOG for the press and media, although it and its partners will be designing venues to maximise wired connectivity.
- 4.91 Certain equipment may be exempted in the UK from the requirement to be licensed under the Wireless Telegraphy Act 2006 because its use is not likely to cause harmful interference. Experience from past Games has shown, however, that the unusual concentration of such equipment in particular venues can create the potential for localised harmful interference.
- 4.92 We are exploring with LOCOG how such use can best be controlled and/or 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.
- 4.93 The Met Office raised concerns in its response 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. Ofcom will carry out a detailed study of the protection of meteorological radars from WLANs and will consider how WLAN use can best be controlled and/or coordinated to avoid any disruption to the meteorological radars.
- 4.94 Table 16 sets out the available bands, maximum power levels and applicable IRs.

**Table 16. Bands available for WLANs on a licence exempt basis**

Band (MHz)	Maximum power	Applicable IR
2400-2483.5	100 mW EIRP	IR 2005 <sup>30</sup>
5150-5350	200 mW mean EIRP 10 mW/MHz mean EIRP density in any 1 MHz band – TPC and DFS implemented	IR 2006 <sup>31</sup>
5470-5725	1 W mean EIRP 50 mW/MHz mean EIRP density in any 1 MHz band – TPC and DFS implemented	

- 4.95 The Vancouver Organising Committee of the 2010 Olympic and Paralympic Winter Games (VANOC) will be providing both wired and, in certain high-traffic locations such as the Olympic and Paralympic Villages, the MPC and the Media Centre, WLAN Internet services. Within Olympic Net Zone wireless hotspots, use of personal WLAN routers will not be permitted. Use of WLAN routers will be permitted in designated locations outside these Zones. Anyone bringing in their own WLAN services will have to use the 5000 MHz band and the 802.11a networking standard. They will not be able to use the 2400 MHz band (802.11 b/g/n) or selected channels at 5000 MHz (802.11 a/n). VANOC will stipulate the SIDH and channel assignment.
- 4.96 LOCOG has not yet made any similar decisions about the London 2012 Games, but controlling use of the 2400 MHz and 5000 MHz bands could help to reduce congestion for WLANs and harmful interference to other services.

## Football venues

- 4.97 We have 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 including other comparable events at the Athens and Beijing Games, the 1998 FIFA World Cup and the 2008 UEFA European Football Championship.
- 4.98 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).
- 4.99 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 requirements in advance and developing a detailed understanding of the characteristics of the venue – i.e. a venue-specific plan. We will nonetheless review

<sup>30</sup> [www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/uk2005.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/uk2005.pdf).

<sup>31</sup> [www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/uk2006.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/uk2006.pdf).

our assessment and the implications for spectrum availability in the light of future arrangements between LOCOG and the venue operators.

- 4.100 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 for the London 2012 Games.

### **Wireless CATV**

- 4.101 This is an OBS project, still in the pilot phase, to provide news flashes to RHBs via handheld devices. Subject to the outcome of testing in the next few months, it will most probably be deployed at the Vancouver Games.
- 4.102 If it is deployed at the London 2012 Games, wireless CATV would provide local venue-wide coverage for a number of venues. OBS has not yet decided the venues at which it would be deployed but, drawing on the experience of preparations for the Vancouver Games, would probably focus on those with greatest spectator demand.
- 4.103 Wireless CATV, as currently piloted, would need an 8 MHz channel in UHF Band IV or V. 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.

### **Cultural events**

- 4.104 This section sets out our assessment and proposals for spectrum for cultural events, - the Opening and Closing Ceremonies, team-welcome ceremonies and medal/victory ceremonies and the torch relays. These are mandatory ceremonies and fall within the scope of the Government's spectrum guarantees. Other events and celebrations do not fall within the guarantees, but Ofcom is mindful of their importance in creating an overall impression for visitors to London at the time of the London 2012 Games.

### **Olympic and Paralympic Opening and Closing Ceremonies**

- 4.105 The Opening and Closing Ceremonies of the Games are watched by a worldwide audience of billions of people. They will welcome the world to London and set the tone for the London 2012 Games. They will recognise the competing athletes and celebrate the Olympic and Paralympic values and spirit of friendship in a spectacular display. They will draw on the expertise and resources of the UK's creative industries. They will also provide opportunities for the whole of the UK to engage with the London 2012 Games through Live Sites in their cities, regions and nations.
- 4.106 The Opening and Closing Ceremonies will generate large requirements for spectrum and are likely to represent the peak demand for some services (e.g. wireless microphones and IEMs). They are addressed by our proposals elsewhere in this document.

### **Team-welcome ceremonies**

- 4.107 Each national team will be welcomed to London as they arrive at the Olympic Village. There will be 205 teams competing at the London 2012 Games, but up to five nations might be welcomed in each ceremony.

- 4.108 During these team-welcome ceremonies, national teams are greeted by the honorary Village Mayor, and their national flag is raised on arrival to join flags of the other competing nations, alongside those of the UK and the Olympic and Paralympic Movements. We are not aware of any special demand that these ceremonies will place on spectrum.

### **Medal/victory ceremonies**

- 4.109 During victory ceremonies across the London 2012 Games venues, athletes will be awarded medals and honoured for their achievements. IOC protocol dictates presenting medals and a bouquet, raising national flags and playing the national anthem of the winning nation.
- 4.110 LOCOG will begin planning these ceremonies in 2010. However, based on the experience of other host cities and bearing in mind the views of the IOC, LOCOG will need to plan medal ceremonies that occur in the venue in which the medal was won and as soon after the sporting event as possible. We are not aware of any special demand that these ceremonies will place on spectrum.

### **Olympic and Paralympic torch relays**

- 4.111 We expect the spectrum requirements generated by the torch relays will not exceed the availability of spectrum used on a day-to-day basis. Where that spectrum is not available on a UK-wide basis, we will endeavour to minimise the operational implications.
- 4.112 Ofcom will test its spectrum plan at a number of special events prior to the London 2012 Games. We will use the information obtained from these events to improve and refine our spectrum plan.
- 4.113 Current procedures for accessing spectrum needed during the London 2012 Games in some locations, especially those in close proximity to the London 2012 Games venues themselves, will be enhanced and Ofcom is developing a licensing process that will provide flexibility to deal with changing requirements.
- 4.114 Spectrum for the Olympic and Paralympic torch relays will be sought from the normal PMSE sources. In the case that these are not sufficient, the spectrum bands set out in this plan may be called on to supplement availability.

## **Non-guaranteed services**

### **Introduction**

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

### **Public services**

- 4.116 Non-guaranteed public services primarily support the organisation of the London 2012 Games and/or have a presence at venues.

- 4.117 The Public Safety Spectrum Policy Group (PSSPG) is responsible for considering the spectrum requirements at the London 2012 Games of the services within its remit. PSSPG is, like SPGOG, a subcommittee of UKSSC. It comprises representatives from Ofcom, the Department for Business, Innovation and Skills (BIS), the Home Office, the Scottish Government, the Department for Communities and Local Government and the Department of Health. The MOD participates as required. PSSPG is chaired independently and its technical subgroup manages day-to-day assignments of spectrum for E&PSS.
- 4.118 Ofcom will continue to work 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 for the London 2012 Games.
- 4.119 We envisage that non-guaranteed public services with spectrum requirements generated by the unique nature of the London 2012 Games will be satisfied from existing assignments or the market, with Government direction and administrative assignment only if an exception is necessary and justified. We will nonetheless seek to ensure that any such requirements can be met. We will also ensure that they are coordinated with the requirements for guaranteed services. We will continue to work closely with E&PSS and transport services to ensure that their expected requirements for the London 2012 Games will be fully met.

### **Private services**

- 4.120 Non-guaranteed private services primarily improve the experience of the London 2012 Games – some significantly so - but are not directed by LOCOG or others directly responsible for the organisation of the London 2012 Games. Any spectrum requirements generated by the unique nature of the London 2012 Games will have to be met through the market and existing assignment processes.
- 4.121 At the same time, we recognise and acknowledge the importance of 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**

- 4.122 Access to spectrum for non-rights-holding broadcasters will be made clear when we publish our arrangements for licensing for the London 2012 Games (see Section 5).

### **Public mobile communications**

- 4.123 The five UK mobile-network operators (MNOs) and the ODA have been discussing 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 ODA agreed with LOCOG and submitted for planning approval on 5 February 2009.
- 4.124 LOCOG will lead on the coordination, planning and provision of any temporary radio-distribution infrastructure required within venues. This will primarily be for E&PSS 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.

## Other events and celebrations

4.125 We expect the spectrum requirements generated by events and celebrations that do not fall within the scope of the Government's spectrum guarantees to be met through normal PMSE processes. 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.

4.126 These events and celebrations include:

- Major national projects. 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. They will be phased in over the coming three years and, in most cases, will deliver in the period up to Games time. Plans include major events in London and other cities across the UK in the immediate pre-London 2012 Games period;
- Live Sites. The Handover Ceremony in Beijing and the Party on the Mall were broadcast live on giant screens to more than 250,000 people in more than 30 locations around the UK. 20,000 people in Cardiff, 15,000 in Weymouth, 6,000 in Glasgow, 30,000 in Liverpool and 10,000 in Belfast were among those getting together to watch. Millions more tuned in on BBC One and Radio 2. LOCOG plans to develop up to 60 Live Sites (temporary, mobile and permanent) – giant screens and live performance spaces – in the run up to the London 2012 Games. Screens are developed in partnership between LOCOG (which provides the infrastructure), the local authority (which maintains the screen and provides day-to-day management of the space) and the BBC (which provides and manages much of the content), along with a range of other film and video contributors. Together and individually, there will be a range of events during Games time as a climax and focus for the UK celebrations; and
- UK-wide cultural festival. This will feature a mix of projects in which a whole range of communities is taking part. It is an entirely new scheme, not tried at previous Games, so LOCOG is starting with just a small number of projects or events – currently some 100 in 2009 but hopefully growing to much larger numbers by 2012. It will be selecting carefully to make sure it gets a good balance across every nation and region of the UK. Chosen projects will be granted the right to use the "Inspire Mark" on various project materials, such as posters, brochures and websites. The Inspire Mark is part of the London 2012 Games brand family and recognises that a project has been "inspired by London 2012" and reflects the values of the Olympic and Paralympic Movements.

## Short-term restricted-service licences (S-RSLs) and short-term digital radio services

4.127 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. It may also be possible to make spectrum available for the provision of short-term digital services during the London 2012 Games.

- 4.128 We are currently planning to invite preliminary expressions of interest in short-term London 2012 Games-related broadcast radio services early in 2010. This will help us assess competing demands and consider the possibility of making spectrum available for such services.

## **Innovation and legacy**

### Innovation

- 4.129 LOCOG's telecoms services will be provided on a mature, proven and reliable technology base, which is vital for the smooth operation of the London 2012 Games. There may be some opportunity for LOCOG partners to showcase innovative communications solutions, but the main operation of the London 2012 Games will not be based on these services.
- 4.130 We do not have a direct role in promoting innovation at the London 2012 Games. We will, however, support LOCOG's and others' roles in line with our duty under the Wireless Telegraphy Act to have regard to the desirability of promoting the development of innovative services in carrying out our spectrum functions.

### Legacy

- 4.131 After the London 2012 Games, the Olympic Park will be transformed into a world-class, sustainable and prosperous neighbourhood, with outstanding sporting, educational and cultural facilities, surrounded by over 100 hectares of parkland.
- 4.132 We have agreed with the Government that its spectrum guarantees do not extend beyond the end of the London 2012 Games and so do not cover legacy. Spectrum temporarily made available by UK public sector bodies will be returned to them once the London 2012 Games requirement has ended. Thereafter, new spectrum will need to be secured through existing allocation and assignment processes or through the market.

## Section 5

# Operations and Licensing

## Introduction

- 5.1 We have worked closely with the Ministry of Industry and Information Technology in China, Industry Canada, the Hellenic Communications and Post Commission in Greece, the Australian Communications and Media Authority and the Agence Nationale des Fréquences in France to identify operational issues based on their experience of past Games and comparable events. We experienced these firsthand during the London stages of the 2007 Tour de France.
- 5.2 This section sets out proposed high-level approaches to licensing (authorisation) and interference management for the London 2012 Games drawing on these experiences.

## Licensing

- 5.3 The London 2012 Games present a special challenge to our normal licensing arrangements due to the volume and variety of requests for spectrum we will receive. We have worked closely with LOCOG and other spectrum regulators responsible for past Games and comparable events to understand and learn from their experiences. As a result of those discussions, we believe the scale of the London 2012 Games and the unique challenge it presents for interference management make it necessary to establish special licensing arrangements.
- 5.4 Consequently, we plan to establish a licensing regime specifically for users covered by the Government's spectrum guarantees. The regime will provide for licences tailored to their specific needs and designed to make the most efficient use of the available spectrum.
- 5.5 At recent Games, it has been possible for members of the Olympic Family to apply for spectrum licences using an Internet-based Rate Card ordering system operated by the host organising committee. This approach has proved popular with both users and regulators and we plan to adopt a similar approach. Such a system would be based on those at past Games, albeit configured so the information supplied conforms to our requirements for processing requests.
- 5.6 Respondents to the consultation made important observations about the need for proper provision of licensing arrangements for both Olympic Family members and other stakeholders. They also noted that such arrangements should avoid the inconvenience and confusion that could arise from requiring stakeholders to seek spectrum authorisation from a number of different sources. Dealing with these issues would require effective cooperation between Ofcom and the new band manager with obligations to PMSE users<sup>32</sup>, which will replace our current licensing arrangements for PMSE and about the arrangements for which we have recently consulted.
- 5.7 Respondents to the most recent consultation, which closed on 7 September 2009<sup>33</sup>, have provided valuable input on licensing issues for the London 2012 Games. Until we have fully considered both sets of responses we believe it is inappropriate to

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<sup>32</sup> <http://www.ofcom.org.uk/consult/condocs/bandmgr/condoc.pdf>

<sup>33</sup> <http://www.ofcom.org.uk/consult/condocs/bandmanager09/>

reach a definitive view about licensing arrangements for the London 2012 Games for all stakeholders. We will set out our conclusions on the licensing arrangements for the London 2012 Games in due course.

## **Coordination with non-London 2012 Games use**

- 5.8 Some of the spectrum identified in this spectrum plan will be shared with non-London 2012 Games users. In the run-up to and during the London 2012 Games it may be necessary to coordinate some of this use with the requirements of the London 2012 Games. In performing this task, we will seek to strike an appropriate balance between ensuring the success of the London 2012 Games and minimising their impact on other spectrum users. We are currently examining ways in which this can best be achieved. There are a number of options, and our current view is that we will use a combination of the following:
- identifying particular channels that are set aside for London 2012 Games use and not otherwise available for their duration;
  - establishing geographic coordination zones where we will perform the necessary technical checks to ensure proper coordination between London 2012 Games and non-London 2012 Games use; and
  - establishing geographic exclusion zones around London 2012 Games venues where any spectrum use will require specific additional authorisation from us.
- 5.9 In certain circumstances, it might be necessary to revoke or temporarily vary licences to allow spectrum use for the London 2012 Games. We believe such circumstances are likely to be very rare, and we would endeavour to explore all options to accommodate both London 2012 Games and non-London 2012 Games use prior to taking such action.
- 5.10 We are currently examining how best to ensure efficient coordination between shared London 2012 Games and non-London 2012 Games use of the same spectrum. It is likely that arrangements will vary by band and by service. We will publish more details in due course.

## **Licence exempt equipment**

- 5.11 Certain equipment may be exempted in the UK from the requirement to be licensed under the Wireless Telegraphy Act 2006 because its use is not likely to cause harmful interference. Experience from past Games has shown, however, that the unusual concentration of such equipment in particular venues can create the potential for localised harmful interference.
- 5.12 We are exploring with LOCOG how such use can best be controlled and/or 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.

## Interference management

- 5.13 Our goal is to deliver a flexible and robust plan for managing the London 2012 Games that will optimise the deployment of Field Operations resources and will provide the best possible experience for our customers - the spectrum users.
- 5.14 In order to achieve this, we will build on the best practice that has been applied at previous Games.

## Equipment validation

- 5.15 As stated in the consultation, we will consider providing a validation service for wireless transmitter equipment that will be used within key London 2012 Games venues. The purpose of this service would be to establish whether equipment settings are consistent with the authorisation to use the equipment.
- 5.16 With regard to the delivery of the validation service, we are examining the following options:
- the deployment of our own staff and equipment;
  - outsourcing to one or more external organisations; and
  - allowing users (accredited according to a quality standard approved by Ofcom) to self-certify their own equipment.
- 5.17 We will also consider inspecting certain key radio installations as part of this service. The purpose of this service would be twofold:
- to establish whether radio transmitter equipment settings are consistent with the authorisation to use the equipment; and
  - to establish whether radio receiver equipment and antenna installations have been engineered to function reliably during the London 2012 Games.
- 5.18 The first step will minimise the risk that the use of radio transmitter equipment will result in harmful interference to other radio users.
- 5.19 The second step will minimise the risk that the radio receiver will experience harmful interference from other radio users. This is important, because poorly engineered systems have the capacity to experience harmful interference caused by other radio transmitters or other electrical or electronic devices that are themselves operating lawfully.

## Spectrum monitoring

- 5.20 As stated in the consultation we will monitor the spectrum required for the London 2012 Games to ensure that it is as free from unauthorised use and unwanted emissions as is reasonably practicable. We agree with the view that it will be necessary to continue to monitor the spectrum during the London 2012 Games.
- 5.21 We currently envisage deploying a network of sensors both within and immediately outside key London 2012 Games venues (to allow low power, high frequency signals to be monitored) and outside the venues (for city-wide area coverage).

- 5.22 We are investigating how best to achieve this, but our goal would be to identify unauthorised use of spectrum and to increase the likelihood that we will be able to end any such use before it has resulted in harmful radio interference. We hope that this pro-active approach to interference resolution will help to improve the experience for authorised users during the London 2012 Games. We are working closely with LOCOG to determine the scope for deploying this equipment.
- 5.23 In order to obtain a detailed understanding of the requirements for specific venues Ofcom will undertake a series of technical surveys. Ofcom will take measurements to ascertain the level of interference received into the venue from elsewhere as well as the level of radio signal that travels outside the venue into the neighbouring area.
- 5.24 Ofcom will work with key stakeholders to review the spectrum demand for specific venues. This will include a review of the need for coordination and/or exclusion zones at certain venues.

### **Interference resolution and enforcement**

- 5.25 No matter how carefully we plan, we know that some spectrum users will unfortunately experience harmful interference either shortly before or during the London 2012 Games. We understand how frustrating harmful interference issues can be, particularly during a live event such as the London 2012 Games. Our goal is to design robust, resilient and customer friendly processes for handling radio interference issues that will:
- make it easy for spectrum users to report issues;
  - where possible provide our spectrum users with the choice of either using an alternative frequency or waiting for action to be taken against the interfering signal source;
  - make it easy for spectrum users to obtain up-to-date information regarding what steps are being taken to resolve the issue, when we expect to resolve the issue and when the case has been closed; and
  - minimise the time required to resolve interference issues.
- 5.26 We would generally expect radio interference issues affecting Olympic Family radio users to be reported to us by LOCOG rather than being directly reported to us by the spectrum user. We are working closely with LOCOG to ensure that we achieve an appropriate level of integration between the Ofcom and LOCOG case management processes. But we will also maintain existing channels for reporting interference issues directly to us, which for high priority (safety critical issues) includes a contact centre that is available on a 24 hour basis.
- 5.27 At this stage we envisage deploying a network of sensors both inside and outside key London 2012 Games venues to allow us to locate the position of any interfering radio signal sources. While the final location of any such signal source will always require an experienced Field Engineer on the ground, we hope that a position location network will allow us to significantly reduce the time required to resolve any radio interference issues that may arise. As with the network of spectrum monitoring sensors described above, we are working with LOCOG to establish the scope for deploying this equipment.

- 5.28 As stated in the consultation, we will consider deploying dedicated interference-resolution teams within key London 2012 Games venues. As well as helping to reduce our response times as far as reasonably practicable, we agree that it is also important for Ofcom to have a visible presence during the London 2012 Games. We are working with LOCOG to determine what resources will be available to support this function (such as in-venue office accommodation and accreditation passes) and this will, in part, shape our own plans.
- 5.29 We will also deploy mobile interference-resolution teams. These mobile teams will be available to deal with sources of radio interference located outside London 2012 Games venues, but will also be available to provide in-venue support if required.

## Testing

- 5.30 We will thoroughly test our equipment, systems and end-to-end business processes before the London 2012 Games. We expect the level of testing to build during 2010 and to include participation in LOCOG's formal test events during 2011. We will work closely with LOCOG to ensure that the appropriate level of testing is successfully completed before the London 2012 Games.

## Test events

### Introduction

- 5.31 A number of test events will be held to test different competition venues and infrastructure. They will vary from full international competitions, including Olympic and Paralympic sports, to technical rehearsals. They will take place from April 2011 until just prior to the London 2012 Games. The test event schedule will be available by December 2009.
- 5.32 The Government has advised us that it regards its spectrum guarantees to include test events organised and led by LOCOG.

### Spectrum plan

- 5.33 The test events will be informative to the spectrum plan for the London 2012 Games for four main reasons:
- the spectrum we are making available is overwhelmingly already used for the services in question, whether in the UK or overseas;
  - spectrum not already available for use in the UK is unlikely to be released until shortly before the London 2012 Games to minimise the impact on existing users;
  - even spectrum that is already available for use may be subject to change (e.g. because of the consequences of DSO); and
  - spectrum requirements for test events will be far less than at Games time due to the difference in the number of concurrent events. This was highlighted in responses to our consultation document.
- 5.34 Stakeholders expecting to use new equipment during the London 2012 Games, particularly where this enables them to use spectrum more efficiently and/or use

higher-frequency spectrum, may wish to test that equipment in advance. We may be able to grant non-operational licences for this purpose<sup>34</sup>.

## Licensing

- 5.35 We may use test events to license spectrum users in a manner similar to our arrangement for the London 2012 Games. This will enable us to determine how best to undertake detailed assignment planning when licensing for the London 2012 Games themselves. We will certainly wish to test any new systems that are required well in advance of the London 2012 Games and may do so not only at test events but also on other occasions.
- 5.36 We will endeavour to cause minimum disruption to those using spectrum on a day-to-day basis. At present, we do not anticipate revoking or varying licences during test events, but should our assessments of demand and supply change, we may need to do so.

## Enforcement

- 5.37 We will work closely with LOCOG to ensure we are involved at an appropriate level in test events to assess and optimise our enforcement activities leading up to the London 2012 Games.

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<sup>34</sup> [www.ofcom.org.uk/radiocomms/ifi/licensing/classes/noperational/](http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/noperational/).

## Annex 1

# Government Guarantees and Ofcom's responsibilities for the London 2012 Games

- A1.1 As part of London's bid for the 2012 Games, the then-Secretary of State for Trade and Industry gave two binding guarantees concerning spectrum to the IOC. These are similar to guarantees given by the Canadian government as part of Vancouver's bid for the 2010 Winter Games.
- A1.2 Guarantee 15.8 of London's bid stated:
- "The Secretary of State for Trade and Industry has guaranteed on behalf of the UK Government the allocation of the frequencies required for the organisation of the London 2012 Games."
- A1.3 Guarantee 15.9 of the bid stated:
- "The Secretary of State for Trade and Industry has guaranteed on behalf of the UK Government to the waiving of fees payable for the allocated frequencies required for the London 2012 Games."
- A1.4 The Secretary of State clarified in a letter to the President of the IOC that guarantee 15.9 applied in respect of the following constituent groups (referred to in this Statement as the Olympic Family):
- athletes;
  - the IOC;
  - LOCOG;
  - national Olympic committees (NOCs);
  - international federations of sport;
  - the media;
  - RHBs; and
  - Olympic partners (i.e. sponsors).
- A1.5 In that letter the Secretary of State confirmed that the UK Government has broad powers of direction to instruct Ofcom, the UK communications regulator, to make such arrangements, in accordance with its statutory functions, to ensure that sufficient and suitable frequencies are reserved and subsequently made available to LOCOG for the organisation of the London 2012 Games.

- A1.6 Ofcom's statutory duties, set out in the Communications Act 2003<sup>35</sup>, include a requirement to secure the optimal use of spectrum in the interests of citizens and consumers. Ofcom is responsible for organising a full spectrum plan for the London 2012 Games in accordance with the Government's guarantees and for arranging all the licences for guaranteed users in good time in support of the plan.
- A1.7 We have agreed with the Government that its spectrum guarantees apply to two broad categories of spectrum use by those covered: PMR and broadcasting. Other services are not covered by the Government's spectrum guarantees, even though they might support the organisation of the London 2012 Games, have a presence at venues and be the subject of other Government guarantees to the IOC (e.g. concerning security). These include military services, E&PSS, security and public transport. Spectrum for these services will have to be secured through existing allocation and assignment processes. We recognise the importance of this and are therefore working closely with members of SPGOG (see below) to ensure that such requirements generated by the unique nature of the London 2012 Games are met and coordinated with other uses.

## Spectrum management

- A1.8 Spectrum is a resource of fundamental importance in the modern world. It is the essential input into every wireless application, from satellites and radars to broadcasting and mobile communications. In the UK, uses of spectrum account for nearly one pound in every thirty in the economy, and its importance is growing fast. Consumers are using ever more wireless products, and innovators are competing ever faster to supply them. But spectrum is a scarce resource in very short supply, so how it is managed is vital.
- A1.9 Generally, our vision for spectrum management, as set out in the Spectrum Framework Review<sup>36</sup>, is for market forces to play an increasingly important role in determining how spectrum is used. We believe that this will encourage efficiency in spectrum use by increasing the likelihood that it will be held by those who can make best use of it and by creating more freedom for it to be used for more valuable applications.
- A1.10 Generally, our vision for spectrum management, as set out in the Spectrum Framework Review,<sup>37</sup> is for market forces to play an increasingly important role in determining how spectrum is used. We believe that this will encourage efficiency in spectrum use by increasing the likelihood that it will be held by those who can make best use of it and by creating more freedom for it to be used for more valuable applications.
- A1.11 The London 2012 Games will see an increase in spectrum requirements, principally in London, where spectrum is already heavily used. Meeting these requirements, and hence the Government's spectrum guarantees, is a complex task. We are also concerned to minimise any negative impact on other spectrum users and, ultimately, on citizens and consumers who benefit from those uses.
- A1.12 It is for these reasons that we started the task of spectrum planning for the 2012 Games in 2006, some six years before they begin, before the Beijing 2008 Games took place and far earlier than any other host spectrum regulator. Such long lead

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<sup>35</sup> [www.opsi.gov.uk/acts/acts2003/pdf/ukpga\\_20030021\\_en.pdf](http://www.opsi.gov.uk/acts/acts2003/pdf/ukpga_20030021_en.pdf).

<sup>36</sup> [www.ofcom.org.uk/consult/condocs/sfr/sfr2/sfr.pdf](http://www.ofcom.org.uk/consult/condocs/sfr/sfr2/sfr.pdf).

<sup>37</sup> [www.ofcom.org.uk/consult/condocs/sfr/sfr2/sfr.pdf](http://www.ofcom.org.uk/consult/condocs/sfr/sfr2/sfr.pdf).

times inevitably increase the uncertainty with which we must contend, particularly in accurately assessing the spectrum requirements of the London 2012 Games. We have looked closely at past Games and comparable events and we have already successfully planned for and met the requirements of the London stages of the 2007 Tour de France. We have used this information and experience for the benefit of the London 2012 Games.

## Authorising spectrum use

A1.13 Effective authorisation arrangements will be essential to ensure spectrum use for the London 2012 Games is efficient and properly coordinated and the risk of harmful interference is minimised.

A1.14 We authorise civil use of spectrum in the UK in two ways:

- by exempting use of particular equipment from the requirement to hold a licence under the Wireless Telegraphy Act 2006<sup>38</sup>; and
- by granting such licences.

A1.15 Under section 8(1) of that Act, it is unlawful to establish, install or use wireless telegraphy equipment without holding a licence granted by us, unless the use of such equipment is exempted. Each authorisation generally provides the right to transmit at particular powers, on a particular frequency and in a particular geographic area. Unauthorised use of spectrum is a criminal offence, the maximum penalty for which on conviction is a two-year prison term and/or an unlimited fine.

## Economic and financial considerations

A1.16 In general, spectrum used by one party in a particular location cannot be used by another because of the interference that would be caused. In other words, there is an opportunity cost to spectrum use. Making users face this opportunity cost encourages efficient spectrum use because they will use spectrum when it generates benefits greater than the opportunity cost. This is the logic behind Administered Incentive Pricing, which attempts to reflect the opportunity cost of spectrum use in licence fees in order to incentivise efficient use.

A1.17 The focus of the Independent Review of Radio Spectrum Management by Professor Martin Cave was the creation of incentives and opportunities for users to make the most economically productive use of spectrum<sup>39</sup>. It recommended that:

“all classes of users should face financial incentives to economise on the spectrum they occupy: this will entail paying a positive price to obtain access to spectrum.”

A1.18 This was aimed at both public and private sector spectrum users, noting that for the former

“the primary means of encouraging spectrum efficiency should be administratively set spectrum pricing.”

A1.19 The Government’s response stated that:<sup>40</sup>

<sup>38</sup> [www.opsi.gov.uk/acts/acts2006/pdf/ukpga\\_20060036\\_en.pdf](http://www.opsi.gov.uk/acts/acts2006/pdf/ukpga_20060036_en.pdf).

<sup>39</sup> [www.ofcom.org.uk/static/archive/ra/spectrum-review/2002review/1\\_whole\\_job.pdf](http://www.ofcom.org.uk/static/archive/ra/spectrum-review/2002review/1_whole_job.pdf).

“we will apply administrative incentive pricing where spectrum has not been auctioned.”

A1.20 In addition, the Independent Audit of Spectrum Holdings, also by Professor Cave, concluded that<sup>41</sup>:

“AIP (Administered Incentive Pricing) is, and is likely to remain, a fundamental element in recognising the value of public sector spectrum use and encouraging improved spectrum efficiency.”

A1.21 The Government response and action plan agreed:<sup>42</sup>

“that administered incentive pricing (AIP) remains an important tool for promoting efficient use, that it should be applied more consistently, and should more accurately reflect the market value of the spectrum.”

A1.22 Consistent with the duties, principles and policies set out above, we believe that, where fees for spectrum users at the London 2012 Games are waived under the Government guarantees, those fees should be met by the Government. In this way, the relevant decision-makers will face incentives to ensure that spectrum is used efficiently where it needs to be used at all. Where the guarantees do not apply, Ofcom would expect that the normal licence fees would be paid by the licensees.

A1.23 The MOD has said that its strategy for defence spectrum should be read in the context of the UK’s upcoming spectrum commitments for the London 2012 Games. The MOD has stated that the implications for its spectrum strategy will be taken into consideration, but in any event the MOD anticipates that any spectrum it provides for use for the London 2012 Games will be returned after they have concluded.

## Governance

A1.24 Both UKSSC and the Olympic Board have responsibilities and expertise of direct relevance to spectrum planning for the London 2012 Games.

A1.25 UKSSC:

- draws up policies and strategic plans for the future allocation of spectrum in such a way as to meet the needs of users in both the public and private sectors and in industry, with emphasis on the provision of vital services and the generation of national wealth;
- oversees the management and regulation of spectrum to ensure that agreed plans are correctly implemented, that efficient use is made of available capacity and that spectrum is used to the best national advantage; and
- determines positions in line with national interests to be taken by the UK in international fora dealing with spectrum management.

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<sup>40</sup> [www.ofcom.org.uk/static/archive/ra/spectrum-review/govresponsetoreview/indpreviewgovtresponsefinal.doc](http://www.ofcom.org.uk/static/archive/ra/spectrum-review/govresponsetoreview/indpreviewgovtresponsefinal.doc).

<sup>41</sup> [www.spectrumbauidit.org.uk/pdf/20051118%20Final%20Formatted%20v9.pdf](http://www.spectrumbauidit.org.uk/pdf/20051118%20Final%20Formatted%20v9.pdf).

<sup>42</sup> [www.spectrumbauidit.org.uk/pdf/governmentresponse.pdf](http://www.spectrumbauidit.org.uk/pdf/governmentresponse.pdf).

- A1.26 UKSSC is jointly chaired by BIS and the MOD. Membership is open to Government departments and their agencies plus Ofcom and the devolved administrations.
- A1.27 The Olympic Board provides oversight, strategic coordination and monitoring of the London 2012 Games, ensuring the delivery of the commitments made to the IOC when the Games were awarded to London and a sustainable legacy from the staging of the London 2012 Games. It is made up of the Minister for the Olympics, the Mayor of London, the Chairman of the British Olympic Association and the Chair of LOCOG<sup>43</sup>.
- A1.28 Recognising the roles of these two bodies, SPGOG was established in January 2007 to support us in meeting our responsibilities toward the London 2012 Games. Although formally a subcommittee of UKSSC, its membership extends to and beyond those represented on the Olympic Board. SPGOG's terms of reference may be found in annex 6 of our consultation document<sup>44</sup>.
- A1.29 As noted above in paragraph A1.5 the Secretary of State has the power under the Communications Act 2003 and the Wireless Telegraphy Act 2006 to give us directions in respect of our spectrum-management functions, including for the purpose of securing compliance with the UK's international obligations. The Government has advised us that it regards its guarantees to the IOC as constituting such obligations.

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<sup>43</sup> [www.london2012.com/about/the-people-delivering-the-games/stakeholders/olympic-board](http://www.london2012.com/about/the-people-delivering-the-games/stakeholders/olympic-board).

<sup>44</sup> <http://www.ofcom.org.uk/consult/condocs/london2012/>

## Annex 2

# Summary of Responses

## Approach

### **Question 1. Do you have any comments on the three approaches we have taken to spectrum planning for the London 2012 Games?**

A2.1 There were divergent views on whether a 'top-down' or 'bottom-up' approach to the estimation of demand should be assumed, but there was general agreement that publicly available information on the demand for spectrum at large events should be used where this is available and that it was reasonable to assume that demand at the London 2012 Games will be higher than at past Games. We were also asked to do more to take into account existing ("day-to-day") users in our approach.

### **Ofcom's response**

A2.2 Ofcom will continue to use information from 'top-down' analyses and more detailed information from a 'bottom-up' approach to revise the spectrum plan when this is necessary. We will develop venue-specific spectrum plans and consider the environment within which different events are taking place and we will review our assessment of the demand for spectrum in the light of information provided by the Vancouver Games in 2010 and other events that may provide additional information.

### **Question 2. Do you have any comments on the scope for reducing demand by using fibre-wireless networks within venues?**

A2.3 There was support for the view that the demand on spectrum could be reduced by using fibre-wireless networks. Reasons for this included:

- improvements in the quality of the received signal that can be achieved; and
- more resilient (communication) links.

### **Ofcom's response**

A2.4 The demand for spectrum could be reduced by using fibre-wireless networks, but broadcasters may only resort to wireless technologies where wired alternatives are not practicable. The use of wireless cameras in and around a stadium for example, according to Wembley National Stadium, is generally dictated by the flexibility and mobility that the broadcasters require for a particular event and in locations (players line-up on pitch for example) where a wired connection is simply not viable. Ofcom will continue to encourage broadcasters to use wired connections wherever possible.

### **Question 3. Do you have any comments on the scope for reducing demand by deploying a London-wide cellular receive system?**

A2.5 One respondent said they would not be able to rely on a London-wide cell plan as they would have to assume it would not be present when and where they might

need it in response to breaking news. This view was echoed by the BBC and SiSLive because the point of delivery for the feed will always be an outside broadcast (OB) van at the venue and the host broadcaster will normally require continuous, exclusive use of a camera feed. Both the BBC and SiSLive suggest that such a system could be used for 'beauty shots'. LOCOG's view is that as it halves the spectrum requirement for cameras it is worthwhile considering particularly since this approach is proven as it has been used successfully at previous events. Both OBS and RAYNET identified the cost implications of a London wide cellular receive system.

## Ofcom's response

A2.6 A London-wide cellular network could deliver valuable benefits to users, including reducing the requirement for spectrum resources. To be adequate for SNG operations it would require careful planning and management. Responsibility for building such a network would lie with others, but Ofcom encourages the relevant bodies to consider doing so.

## Question 4. Do you have any other comments on the scope for reducing demand by relying more heavily on wired communications?

A2.7 The BBC and SiSLive said that they do not think that there is scope for reducing demand by relying more heavily on wired communications. Wired links are preferred to wireless links where practicable, but not where mobility is needed. SiSLive said that improved digital technology has led to an increased demand for mobility in cameras and microphones and that, in certain specialised camera tracking systems, fibre optic systems may replace wireless, but these are very few in number.

A2.8 One respondent commented that point-to-point circuits dedicated to specific broadcasters and/or categories of video operators (broadcaster/agency/online) would reduce the need for wireless communications. The circuits would have to be both video and un-contended broadband internet to accommodate different work flows.

A2.9 LOCOG and the RSGB supported the view that maximising use of wired and existing infrastructure can greatly assist in reducing additional spectrum requirements. Another respondent said that it would be helpful, from a content delivery perspective, for plug-in points to be made available around the city via which ENG coverage could be delivered for packaging.

## Ofcom's response

A2.10 There appears to be limited scope for reducing demand for broadcast cameras by relying more heavily on wired communications unless new facilities such as plug-in points for content delivery can be made widely available. Wired communications cannot substitute for wireless when mobility is required.

## **Question 5. Do you have any comments on the scope for maximising supply by using spectrum more efficiently?**

- A2.11 The BBC raised a number of points on maximising supply by careful interference management. These points included paying attention to the out-of-band characteristics of the transmitter equipment used, avoiding adjacent channel deployment to minimise the effect of adjacent channel leakage and taking care with the location of receive antennas to avoid line of sight propagation from 3G base stations. A respondent suggested fitting transmit and receive filters to maximise the ability to co-locate wireless camera transmitters on adjacent channels.
- A2.12 JFMG and LOCOG suggested off-setting centre frequencies for wireless cameras to increase efficiency between venues and OBS supported 'tight' channel allocation and geographic re-use provided no interference can be guaranteed. However, SiSLive said they do not believe that there are any practical methods of improving spectrum supply by more efficient use of spectrum that will not degrade link performance to some degree. Wembley National Stadium suggested a more definitive venue specific spectrum plan be prepared in advance of the London 2012 Games and BBC Regional suggested the re-use of spectrum 2450 MHz to 2600 MHz at the Olympic site as a temporary measure as this would be less disruptive to users of the 2000 MHz to 2300 MHz band.

### **Ofcom's response**

- A2.13 Ofcom notes the comments on out of band (OOB) characteristics and adjacent channel leakage (ACLR). After the publication of the plan and before we finalise the spectrum assignment and licensing arrangements we will undertake:
- ii) a review of current standards and consider equipment restrictions and typical channel plans before we assign frequencies and grant licences;
  - iii) encourage users to fit filters where this is feasible to maximise the ability to co-locate wireless camera transmitters on adjacent channels, but Ofcom has no plans to supply such filters;
  - iv) conduct further studies into interference from 3G base stations into PMSE receive points and encourage the adoption of voluntary codes of practice that can prove effective in regard to the location of base stations;
  - v) conduct spectrum surveys to establish the quality of key spectrum;
  - vi) undertake a review of wireless microphone technologies and wireless cameras, noting the view that it is unlikely that products would be used in significant numbers before 2012;
  - vii) retain a number of options for spectrum supply for wireless microphone technologies and wireless cameras until the picture of demand for these is more completely understood; and
  - viii) develop venue-specific spectrum plans where these are needed.

## **Question 6. Do you have any comments on the scope for maximising supply by reusing spectrum efficiently?**

- A2.14 A respondent said that a London-wide wireless camera frequency in the 2000 to 3000 MHz range for use both inside and outside the Olympic Park is needed to enable rapid deployment of newsgathering operations.
- A2.15 The BBC raised a number of detailed technical points that may increase spectrum supply such as careful planning of spectrum re-use (also mentioned by LOCOG and SiSLive) and considering operation at reduced output power provided there is sufficient power for an adequate fade margin. This approach is supported by JFMG in its comments. The BBC also supported the need for tests in advance of the London 2012 Games.
- A2.16 For point-to-point links the BBC suggested that high gain antennas should be used, but for mobile video links they suggested that Ofcom takes the transmission mode into account. JFMG supported this view and additionally mentioned the need to avoid allocating high and low power wireless camera use in the same frequency band – a view supported by SiSLive. OBS suggested that where possible the same user should be allocated the re-used frequencies so as to provide an incentive for the users to co-operate in the process of identifying interference problems.
- A2.17 RAYNET suggested that we should emphasise the need to protect services outside London from the effects of the London 2012 Games and put forward a number of ways in which mitigation might be achieved such as site-specific shielding.

### **Ofcom's response**

- A2.18 Ofcom plans to offer licences that will allow for London-wide camera use both inside and outside the Olympic Park within the 2000 MHz to 4000 MHz range, with constraints on deployment only when necessary. We will continue to engage with all key stakeholders as we develop the detailed plan of licence assignments to be made under this Spectrum Plan. We will consider the technical parameters of stations and look for opportunities to improve spectrum re-use as we develop our assignment and licensing process. Any further studies that Ofcom undertakes into the parameters of stations, including any practical testing and the need to balance efficient spectrum use and the risk of interference will be taken into account in our assignment plan.

## **Question 7. Do you have any comments on the scope for maximising supply by using higher-frequency spectrum?**

- A2.19 JFMG and another respondent supported the view that use inside venues of higher frequency bands is possible. The BBC referenced the Sagentia report<sup>45</sup> as evidence of the use of frequencies such as 7000 MHz within stadia or other confined areas. Similarly, the BBC highlighted the possibilities of operation beyond 10 GHz, but identified that these uses are limited by antenna aperture, propagation characteristics and the high cost of circuit components. The BBC also highlighted that the required transmitter power increases as the square of frequency and hence health and safety issues can become a concern. Wembley Nation Stadium supported the BBC's view concerning RF health and safety and identified that antenna separation considerations need to be incorporated into an overall plan for

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<sup>45</sup> Reference supplied by the BBC: [http://www.ofcom.org.uk/consult/condocs/spectrum2012/shf\\_ehf/report.pdf](http://www.ofcom.org.uk/consult/condocs/spectrum2012/shf_ehf/report.pdf)

deployment so as to minimise the impact all wireless deployments may have on spectators and workers inside the stadium during an event.

- A2.20 More generally, the RSGB said that they believe that there are many opportunities (licensed and exempt) for millimetre-wave bands to facilitate data links for example and minimise pressures on lower frequencies.
- A2.21 The BBC point to a lack of willingness to invest in equipment that operates at higher frequencies unless there is a commercially viable use of this equipment outside the period of the London 2012 Games. LOCOG identify that these higher frequencies are already used and that wireless camera equipment is available. OBS said that they will certainly use technologies that have guaranteed technical performance and can be offered by the market in the quantities and pricing which appropriate to their use for the London 2012 Games and another respondent said that the cost of investing in the necessary equipment would be high for media organisations who generally own their own equipment.
- A2.22 All the responses to this question supported access to frequencies in the 2000 MHz to 4000 MHz range to cover greater distances with more challenging signal paths. LOCOG said that they foresee a very high demand for wireless camera at 2000 to 3000 MHz for the London 2012 Games.

## Ofcom's Response

- A2.23 Ofcom will make spectrum available for London-wide camera use both inside and outside the Olympic Park within the 2000 to 4000 MHz range, with constraints on deployment only when necessary. We will also make available higher frequency bands e.g. at and above 7000 MHz for wireless cameras as we wish to encourage the development and deployment of new technologies in venues where bandwidth for high quality services is needed.
- A2.24 The band 3400–3600 MHz is managed by the MOD and it is identified by them in their spectrum strategy for release to the market prior to the London 2012 Games. However, Ofcom believes that access to this band is very important for wireless cameras (including airborne) subject to coordination with the MOD and other users. Ofcom will consider access to this band with Government.

## Question 8. Would you consider using free-space optics technologies?

- A2.25 The BBC said that the applications for free-space optics technologies are limited, given that they are point-to-point and hence aren't sufficiently mobile for many applications. They also point out that free-space optics technologies have a relatively limited range, and are vulnerable to rain and fog. This is a view supported by, OBS, SiSLive, Wembley National Stadium and another respondent.
- A2.26 The BBC said that free-space optical links are generally used in countries where it is difficult to obtain a *short-notice and/ or short-duration RF licence*. However, they said that their equipment uses analogue technology and is not suited to working in a high definition environment. Both RAYNET and OBS said that it would be possible to reduce some spectrum demand.

A2.27 Wembley National Stadium support the use of free-space optics technologies by broadcasters and other parties who may require communications links between the stadium and any facilities they have outside the stadium demise.

### **Ofcom's response**

A2.28 Ofcom will encourage the development and deployment of new millimetre wave wireless technologies in venues where bandwidth for high quality services is needed. We will also encourage the use of free-space optics technologies by broadcasters and other parties who may require communications links between the stadium and any facilities they have outside the event venues where this reduces the demand for spectrum.

## **Assumptions**

### **Question 9. Do you have any comments on our assumptions?**

#### **Comments on Assumptions**

##### **I. Some 20,000 accredited media staff will cover the London 2012 Games**

A2.29 LOCOG agreed with Ofcom's assumption

### **Ofcom's response**

A2.30 Unless new information emerges, there will be no change to this assumption

##### **II. Wired rather than wireless technology will be used where practicable**

A2.31 LOCOG supported our assumption for competition venues. LOCOG's approach favours wired over wireless solutions, which they are applying for their LAN network. WiFi will still be required in certain areas LOCOG suggest.

### **Ofcom's response**

A2.32 We will continue to assume that wired technology is preferred where practicable because it is more reliable than wireless alternatives and that that wireless cameras, for example, will not be used at all venues or for all events.

##### **III. Spectrum will be required for partners and venue setup from January 2012, for broadcasters from May 2012 and for teams from June 2012**

A2.33 LOCOG said that spectrum will be required for test events and that some applications will need to have access to the same channels during the London 2012 Games and the test events; others will be able to retune within a band. LOCOG anticipate that spectrum demand will increase as we get closer to the London 2012 Games as test events occur as clusters and venues begin their early operations.

### **Ofcom's response**

A2.34 A number of test events will be held to test different competition venues and infrastructure. They will vary from full international competitions, including Olympic and Paralympics sports, to technical rehearsals. The sailing test event is scheduled

for 2010 and others from April 2011 until just prior to the London 2012 Games. The test-event schedule will be available by December 2009.

- A2.35 The Government has advised us that it regards its spectrum guarantees to include test events organised and led by LOCOG.
- A2.36 Stakeholders expecting to use new equipment during the London 2012 Games, particularly where this enables them to use spectrum more efficiently and/or use higher-frequency spectrum, may wish to test that equipment in advance. We may grant non-operational licences for this purpose<sup>46</sup>.
- A2.37 We understand these were typical timescales at past Games. The IBC and the MPC will open in June 2012. The first edition of ODA's transport plan noted that the Olympic Village will open on 13 July 2012, two weeks prior to the Opening Ceremony.
- A2.38 Technology fit-out will occur in time for the start of the test events in April 2011. LOCOG's PMR network will also be ready for service by that time.

#### **IV. All spectrum requirements covered by the Government's spectrum guarantees will cease by the end of September 2012**

- A2.39 LOCOG commented that the spectrum requirement will reduce greatly after the London 2012 Games, especially on the broadcasting side. However, LOCOG states that there is a requirement for spectrum to decommission the venues and maintain security until formal handover. According to LOCOG the demand for spectrum covered by the spectrum guarantees will decrease as LOCOG progresses the decommissioning process, but this will run beyond September 2012. A detailed plan will need to be developed to ensure critical services are maintained during this period.

#### **Ofcom's response**

- A2.40 According to the first edition of ODA's transport plan, the Paralympic Athletes' Village will close on 14 September 2012. Ofcom expects the majority of special requirements for spectrum for the London 2012 Games to cease by this date. Nevertheless, Ofcom's spectrum plan allows for essential requirements that extend beyond 14 September 2012.

#### **V. Wireless equipment is likely to be imported from participating nations**

- A2.41 LOCOG agree with Ofcom's assumption that equipment is likely to be imported from participating nations. However, LOCOG believe that this equipment will need to be approved for use by Ofcom.

#### **Ofcom's response**

- A2.42 As stated in the consultation, we will consider providing a validation service for wireless transmitter equipment that will be used within key London 2012 Games venues. The purpose of this service would be to establish whether equipment settings are consistent with the authorisation to use the equipment.

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<sup>46</sup> [www.ofcom.org.uk/radiocomms/ifi/licensing/classes/noperational/](http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/noperational/).

## **VI. Wireless equipment will be re-tuneable to some extent**

A2.43 All the responses agreed that wireless equipment will be re-tuneable at least to some extent. However, BEIRG pointed out that the extent to which it is re-tuneable is dictated by the type of equipment used and which bands they operate in. Typical high-end wireless microphones have a tuning range of 24 to 32 MHz says BEIRG.

### **Ofcom's response**

A2.44 Unless new information emerges, there will be no change to our assumption that wireless equipment will be re-tuneable at least to some extent.

## **VII. Radiated power for all wireless equipment will be limited to the minimum necessary to obtain required coverage**

A2.45 LOCOG suggested that some guidelines would be useful as part of the communication materials to encourage users to limit the radiated power for all wireless equipment to the minimum necessary to obtain the required coverage.

A2.46 BEIRG said that Ofcom's assumption that wireless microphones will need 100 mW EIRP at most, with 50 mW EIRP sufficing in most cases is generally accurate, although some are available at 250mW EIRP and for some less than 50 mW is sufficient.

### **Ofcom's response**

A2.47 We encourage the adoption of guidelines for efficient spectrum use and will continue to assume that users will adopt best practice in spectrum management as reflected in ERC Reports 38 and 42 and ECC Report 2. In particular, we believe that:

- PMR will need a maximum of 3 W EIRP for handheld-to-handheld communications and 5 W for in-vehicle mobile equipment;
- wireless microphones will need 100 mW EIRP, with 50 mW EIRP sufficing in most cases. However, we note the comment from JFMG that there are no references to 1W audio links or high power IEMs. This requirement will be added to our assumptions; and
- wireless cameras will need 100 mW EIRP in enclosed venues and 1-10 W EIRP for mobile ground-to-air (e.g. motorcycle-to-helicopter) links.

## **VIII. The bandwidth for wireless equipment will not increase**

A2.48 LOCOG suggest that there is a possibility that some HD wireless camera will need more bandwidth and BEIRG confirmed that Ofcom's assumption that the bandwidth for wireless microphones will generally use 200 kHz channels was correct. OBS confirmed that talkback will not require more than 12.5 KHz. However, there may be telecommand applications which could require 25 KHz (telecommand bandwidth for broadcast applications will most probably be in the PMR range). OBS also pointed out that in Beijing they used 20 MHz bandwidth links for video transmissions and that they anticipate having to do the same for certain applications in London.

## Ofcom's response

- A2.49 HD wireless cameras used 10 MHz channels for the London stages of the 2007 Tour de France and the Beijing Games, among other events. Current work on the MPEG-4 encoding technology envisages the same bandwidth for HD. Within this, DVB-T nominally uses only 8 MHz, while the proprietary modulation scheme uses 9.4 MHz, giving additional throughput. However, we agree that it is possible that the bandwidth requirements for HD wireless cameras may increase. If new information emerges, we will review our assumption on the bandwidth for wireless cameras.
- A2.50 We will continue to assume that wireless microphones will generally use 200 kHz channels and acknowledge that in some countries this can be 125-140 kHz. We will also continue to assume that the bandwidth for IEMs can reach up to 300 kHz and that talkback typically uses 12.5 kHz channels.
- A2.51 Our assumption for wireless cameras will be that they require a channel width 10 MHz, but we will take into account OBS' use of some 20 MHz channels in our assumptions.

## **IX. All wireless equipment will comply with the relevant ETSI standards defined in UK Interface Requirements (IRs) even when using spectrum not normally available in the UK**

- A2.52 LOCOG's view is that for spectrum and channel planning purposes this assumption is acceptable. However, LOCOG point out that not all wireless equipment will comply with the European Telecommunications Standards Institute (ETSI) standards as some devices will be brought in from other countries which have other standards such as IEEE. Not all devices will be CE marked either.

## Ofcom's response

- A2.53 For spectrum planning purposes we are assuming that wireless equipment will comply with the Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Regulations 2000, as amended, or operate to a similar technical standard.
- A2.54 We are exploring with LOCOG how equipment that does not comply with the R&TTE Directive (and relevant ETSI standards) can best be controlled and/or coordinated to avoid any disruption to the smooth running of the London 2012 Games. One key element of this approach is likely to be the equipment validation procedures set out in Section 5 of this document. We will publish more details of the technical standards we would expect equipment operating at the London 2012 Games to comply with in due course.

## **X. OBS will capture live video feeds of all sporting events and make them available at the IBC to RHBs**

- A2.55 LOCOG agreed with Ofcom's assumption that live video feeds of all sporting events will be captured and made available at the IBC to RHBs via a fibre contribution network.

## Ofcom's response

- A2.56 We will continue to assume that live video feeds of all sporting events will be captured and made available at the IBC to RHBs via a fibre contribution network.

## **XI. RHBs will contract with the IOC to broadcast those feeds**

A2.57 LOCOG agreed with Ofcom's assumption that RHBs will contract with the IOC to broadcast live video feeds.

### **Ofcom's response**

A2.58 We will continue to assume that RHBs will contract with the IOC to broadcast live video feeds.

## **XII. Those feeds will be mainly in HD**

A2.59 LOCOG and OBS agreed with Ofcom's assumption that most live video feeds will be mainly in HD. OBS noted that some RHBs will still want to receive live video feeds in standard definition.

### **Ofcom's response**

A2.60 We will continue to assume that that most live video feeds will be mainly in HD. However, we will take into account the requirements of those RHBs wanting to receive live video feeds in standard definition.

## **XIII. Wireless cameras used by OBS will not move between venues (with the exception of those used for wide-area sports)**

A2.61 LOCOG said that wireless cameras will be mostly allocated to a venue however some will be redeployed especially as venues transition between sports and from the Olympic to Paralympics Games. OBS confirmed that wireless cameras used by OBS will not move between venues (with the exception of those used for wide-area sports) as this has been *de facto* the case in some previous Games. However OBS cannot guarantee that they will not move wireless equipment from venue to venue if their production plan so requires.

### **Ofcom's response**

A2.62 These responses indicate that most wireless cameras will remain at one location, which will simplify venue-specific spectrum assignment plans. Ofcom believes that venue-specific assignment plans will be flexible enough to cope with any exceptions.

## **XIV. Lower-frequency spectrum is preferable for wireless cameras**

A2.63 Both LOCOG and SiSLive agree with Ofcom's assumption that lower frequencies are to be preferred for wireless cameras.

### **Ofcom's response**

A2.64 Ofcom will make spectrum available for wireless camera use within the 2000 to 4000 MHz range. We will also make available higher frequency bands e.g. at and above 7000 MHz for wireless cameras as this will increase the capacity for wireless cameras in the venues and operating over short distances. We also wish to encourage the development and deployment of new technologies where bandwidth for high quality services is needed.

## **XV. Adjacent-channel use by wireless cameras is possible**

A2.65 JFMG said that whilst it is possible for wireless cameras to operate in adjacent channels its success relies heavily upon both transmitter and receiver performance. Receiver performance can often be the limiting factor in ensuring satisfactory adjacent channel operation. If adjacent channel use is to be relied upon it may be necessary to ensure that spectrum users pay additional attention to their receivers, perhaps by employing additional filtering. SiSLive supports Ofcom's assumption as theoretically correct, but says that in practice the required conditions for adjacent channel working are not always achievable and that it would be a mistake to assume that adjacent channel working would be possible for most operations. OBS commented that they are content with a tight channel assignment provided it can guarantee interference free operations.

### **Ofcom's response**

A2.66 Noting the comments from JFMG and SiSLive, Ofcom will:

- review current standards and consider equipment restrictions and typical channel plans before we assign frequencies and grant licences;
- encourage users to fit filters where this is feasible to maximise the ability to co-locate wireless camera transmitters on adjacent channels, but Ofcom has no plans to supply such filters;
- encourage the adoption of voluntary codes of practice that can prove effective in use of spectrum;
- conduct spectrum surveys to establish the quality of key spectrum;
- retain a number of options for spectrum supply for wireless cameras both above and below 4000 MHz until the picture of demand for these is more completely understood; and
- develop venue-specific spectrum plans where these are needed.

## **XVI. OBS will coordinate all spectrum requirements for broadcasting within venues**

A2.67 LOCOG notes that OBS has an excellent knowledge of the broadcasting spectrum requirement for sporting events but that while OBS represents all the rights holders, individual rights holders will also apply directly for their own spectrum needs. Non accredited media will apply directly. OBS says that it represents all RHBs in any high level communication and general planning requirements. However OBS says it expects the RHBs will request the spectrum they need independently and directly from LOCOG/Ofcom.

A2.68 SiSLive also believes that OBS will have the overview of spectrum requirements for programme making activities within London 2012 Games venues, but OBS will not know about non-London 2012 Games spectrum use outside the fence. OBS role may be to authorise use of spectrum, but not to coordinate in the technical sense. SiSLive said that it is imperative that a single body oversees detailed frequency planning for the London area during the period of the London 2012 Games in a

properly 'joined-up' manner. Only in this way can spectrum use be optimised inside and outside venues and parks.

### **Ofcom's response**

- A2.69 As previously noted, the London 2012 Games present a special challenge to our normal authorisation arrangements due to the volume and variety of requests for spectrum we will receive. We have worked closely with LOCOG and other spectrum regulators responsible for past Games and comparable events to understand and learn from their experiences. As a result of those discussions, we believe the scale of the London 2012 Games and the unique challenge it presents for interference management make it necessary to establish special licensing arrangements.
- A2.70 Consequently, we propose to establish a licensing regime specifically for users covered by the Government's spectrum guarantees. The regime will provide for licences tailored to their specific needs and designed to make the most efficient use of the available spectrum.
- A2.71 Some of the spectrum identified in this spectrum plan will be shared with non-London 2012 Games users. In the run-up to and during the London 2012 Games, it may be necessary to coordinate some of this use with the requirements of the London 2012 Games. In performing this task, we will seek to strike an appropriate balance between ensuring the success of the London 2012 Games and minimising their impact on other spectrum users. We are currently examining a number of ways in which this can best be achieved. We will provide more detail on the arrangements for licensing in a further publication which also takes account of responses to our recent consultation about the band manager with obligations to PMSE users.

### **XVII. Wireless-camera links can be engineered so that more than one receive point is deployed**

- A2.72 No comments were received on this assumption.

### **Ofcom's response**

- A2.73 We will continue to assume that wireless camera links can be engineered so that more than one receive point is deployed.

### **XVIII. RHBs will transport their own feeds back to the IBC in some cases**

- A2.74 LOCOG commented that RHBs may also set up temporary studios outside the IBC such as at hotels and would therefore need to carry their feeds to other non-competition venues.

### **Ofcom's response**

- A2.75 We will continue to assume that RHBs will transport their own feeds back to the IBC, but note LOCOG's point that RHBs may also setup temporary studios outside the IBC such as at hotels and will take this into account in our planning assumptions.

### **XIX. Optical fibre will be used at and link all competition venues within the Olympic Park**

A2.76 LOCOG agrees with Ofcom's assumption that Optical fibre will be used at and link all competition venues within the Olympic Park.

#### **Ofcom's response**

A2.77 We will continue to assume that Optical fibre will be used at and link all competition venues within the Olympic Park<sup>47</sup>.

### **XX. During the London 2012 Games, PMR will be used by NOCs, LOCOG, broadcasters, marketing partners, LOCOG's partners and E&PSS**

A2.78 LOCOG agree with Ofcom's assumption. LOCOG has confirmed that the LOCOG TETRA network is available to all accredited organisations via the Rate Card.

#### **Ofcom's response**

A2.79 We understand this was typical at past Games.

### **XXI. LOCOG will use a PMR trunked network**

A2.80 LOCOG has confirmed that our assumption is correct and that Airwave will deliver a digital secure TETRA Network.

#### **Ofcom's response**

A2.81 Ofcom is working with LOCOG and Government to ensure that spectrum will be available for Airwave to deliver a digital secure TETRA Network.

### **XXII. All PMR will use CTCSS tones/DCS codes to set the squelch automatically**

A2.82 LOCOG asks that Ofcom note that in some case PMR devices could be used to carry data. This is often the case for telemetry applications which do not use licence exempt spectrum. OBS do not object to the use of CTCSS/CDS provided it is for use with radios for general communication purposes. OBS said that for the avoidance of doubt, CTCSS/DCS cannot be used in talkback operations or telecommand operations and they strongly suggest that Ofcom clearly communicates any suggestion for use of CTCSS/CDS tones and requests the agreement of the end user.

#### **Ofcom's response**

A2.83 Ofcom has no plans to introduce requirements for using CTCSS/CDS tones except where this is necessary on spectrum efficiency grounds e.g. to increase spectrum re-use.

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<sup>47</sup> [www.london2012.com/news/media-releases/2008-04/utilities-contracts-awards-help-shape-backbone-of-olympic-park-for-2012-and-.php](http://www.london2012.com/news/media-releases/2008-04/utilities-contracts-awards-help-shape-backbone-of-olympic-park-for-2012-and-.php).

### **XXIII. RHBs will deploy a satellite-dish farm at a fixed location adjacent to the IBC**

- A2.84 BBC said that RHBs will deploy a satellite-dish farm at a fixed location adjacent to the IBC and that RHBs' satellite operations are likely to entail the use of mobile uplink vans as well as a static dish farm at IBC, and hence the extended Ku spectrum is likely to be fully and widely used. Another respondent asked for consideration of developments and demands of satellite on-the-move technologies to be taken into account. SiSLive said that RHBs will be very likely to set up a satellite-dish farm close to the IBC which will have both uplinks and downlinks running continuously. SiSLive also said that Satellite delivery will be critical both for contribution into IBC and outbound from IBC to the RHB's home territory, that the extended Ku spectrum (13.75–14.5 GHz) is likely to be required in full and that Ofcom should minimise the use of fixed links in the 14.25–14.5 GHz band close to London 2012 Games venues as this has the effect of restricting satellite operations.
- A2.85 LOCOG agree that RHBs will deploy a satellite-dish farm at a fixed location adjacent to the IBC, but say that this will be coordinated by OBS.

### **Ofcom's response**

- A2.86 Satellite uplinks have been deployed at past Games to allow broadcasters to send feeds back to their country of origin.
- A2.87 We understand a satellite-dish farm will be deployed close to the IBC. As live video feeds will be available there from OBS, the need to deploy dish farms at other venues will be reduced. However, some RHBs may wish to deploy temporary trucks.
- i) We will pre-coordinate operation of 14/11 GHz for SNG operation at the known Olympic venues in advance which should identify any constraints with respect to FS links and MOD/CAA. These assessments will consider FSS ES transmit into FS links. There is no need for assessment of FSS interference into FSS downlinks at 11 GHz.
  - ii) There are some pre-existing FS links operating at 11 GHz and these may impose constraints on FSS downlink operation – this will be captured in the pre-coordination exercise.
  - iii) Licences to enable Olympic Family members to deploy SNG within Olympic venues will be available through the LOCOG Rate Card in advance of the Games.
  - iv) Ofcom will not authorise any fixed services in the band 10.7-12.75 MHz in locations which affect the London 2012 Games.
  - v) C-Band is not normally available for SNG applications in the UK, although some use may be possible at planned locations, when the transmission requirements are known. Ofcom will consider applications for such use at London 2012 Games venues. It is our expectation that such requests will be dealt with on a case-by-case basis so that the necessary detailed technical coordination with other users of the band can be carried out. We will endeavour to ensure that arrangements for C-Band SNG are as streamlined as possible. Applications for the use of C-Band SNG within London 2012 Games venues will be available through the LOCOG Rate Card in advance of the Games.

#### **XXIV. RHBs might also use satellites to link competition venues back to their facilities in the IBC or at other locations**

A2.88 LOCOG said that its expectation is that the OBS fibre network (geographically diverse) will connect all venues to IBC and satellite links will be limited to the satellite dish farm or road event routes which are temporary in nature. SiSLive commented that RHBs will be very likely to set up a satellite-dish farm close to the IBC, which will have both uplinks and downlinks running continuously. SiSLive also said that satellite delivery will be critical both for contribution into IBC and outbound from IBC to the RHB's home territory.

#### **Ofcom's response**

A2.89 We understand this is normal practice.

#### **XXV. ENG organisations will also use satellites**

A2.90 LOCOG said that they anticipate that outside broadcast and news gathering trucks could be used at all venues. They recommended that areas where satellite uplinks would fail the coordination processes that Ofcom requires are identified as early as possible. LOCOG also said that news gathering organisation will be deploying at short notice anywhere in the country and that this needs to be kept in mind with regards to the coordination process.

A2.91 SiSLive said that the extended Ku spectrum (13.75–14.5 GHz) is likely to be required in full and that Ofcom should minimise the use of fixed links in the 14.25–14.5 GHz band close to London 2012 Games venues as this has the effect of restricting satellite operations.

#### **Ofcom's response**

A2.92 The response described under Assumption XXIII is also valid here.

#### **XXVI. Test events will have comparable spectrum requirements to London 2012 Games events, though there will be additional demand if several London 2012 Games events take place at the same time**

A2.93 The BBC and SiSLive said that they assume that test events will have comparable spectrum requirements to London 2012 Games events, though there will be additional demand if several London 2012 Games events take place at the same time. The BBC also said that since most of the additional frequencies available for the London 2012 Games will not be available before 2012, test events will have to use frequencies currently in use or bookable via JFMG and this is unlikely to provide much useful information as to the problems that may be experienced during the London 2012 Games.

A2.94 LOCOG said that as Ofcom is proposing to use bands which may not have been used previously for broadcasting purposes, it will be extremely useful if these bands are made available before the London 2012 Games to allow for testing and familiarisation. LOCOG suggested that Ofcom should also consider allowing the broadcasters to have access to bands for their day-to-day activities allowing a wider range of testing – ideally local broadcasters could do testing as part of their day to day activities and share their experience with visiting broadcasters via world

broadcasting meetings or broadcasting shows. Test events will vary dramatically in demand for spectrum LOCOG says.

## Ofcom's response

- A2.95 A number of test events will be held to test different competition venues and infrastructure. They will vary from full international competitions, including Olympic and Paralympics sports, to technical rehearsals. They will take place from April 2011 until just prior to the London 2012 Games. The test-event schedule will be available by December 2009.
- A2.96 The Government has advised us that it regards its spectrum guarantees to include test events organised and led by LOCOG.
- A2.97 Stakeholders expecting to use new equipment during the London 2012 Games, particularly where this enables them to use spectrum more efficiently and/or use higher-frequency spectrum, may wish to test that equipment in advance<sup>48</sup>.
- A2.98 Some test events will take place in a single venue with international broadcasters attending. These will afford opportunities for those broadcasters to become familiar with the radio environment and to test equipment with the London 2012 Games in mind. Other events, organised by LOCOG, will take place in clusters of venues that will be closer to the reality of the London 2012 Games with regard to density of use.

## **XXVII. New technologies will need to be proven by the time of LOCOG's technology freeze in 2010 if they are to be relied on at the London 2012 Games**

- A2.99 BEIRG said that Ofcom has assumed that 'new technologies will need to be proven by the time of LOCOG's technology freeze in 2010 if they are to be relied on at the London 2012 Games'<sup>49</sup>. BEIRG said that it is aware that the Minister for the Olympics has stated that 'LOCOG's current expectation is to implement a lock-down on core London 2012 Games technology by the end of 2010'<sup>50</sup>. However, BEIRG said it would welcome greater clarity on the date of implementation of the technology freeze and, indeed, what precisely is meant by 'technology'. BEIRG's reasoning is that under current timescales, the 'white space' maps will not be available until after the international negotiations have concluded in mid-2010. Therefore, the required wireless microphones and IEMs (i.e. those that operate in post-DSO interleaved spectrum) may not exist until after the implementation of LOCOG's technology freeze. However, these applications will, generally speaking, not use 'different technology'; they will use the same technology, but be designed to operate on different frequencies, but still within UHF bands IV and V, hence the requirement for clarity on what the 'technology freeze' actually means.
- A2.100 SiSLive has assumed that the technology freeze is intended to reduce risk but it may need to be applied selectively as in some cases manufacturers and service providers will need maximum available time to develop innovative solutions. SiSLive commented that since it is unlikely that TV production requirements will be known in detail by 2010, care must be taken not to lose the benefits of technical ingenuity in this fast developing field.

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<sup>48</sup> [www.ofcom.org.uk/radiocomms/ifi/licensing/classes/noperational/](http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/noperational/).

<sup>49</sup> <http://www.ofcom.org.uk/consult/condocs/london2012/london2012.pdf> section 4.39

<sup>50</sup> Hansard 8 Oct 2008 : Column 636W

A2.101 LOCOG commented that this technology freeze does not necessarily apply to other Olympic family members.

### **Ofcom's response**

A2.102 LOCOG has told Ofcom that the technology freeze and its timing are matters for LOCOG and its technology partners who will provide a robust and diverse network to ensure the highest service levels are provided to the Olympic Family. This is underpinned by avoiding cutting-edge technology in favour of proven systems.

A2.103 The technology used by other members of the Olympic Family will be a matter for them.

### **XXVIII. Spectrum use can be licensed for periods as short as – or even shorter than – one day, maximising the opportunities for frequency reuse**

A2.104 The BBC says that it assumes that spectrum use can be licensed for periods as short as – or even shorter than – one day, maximising the opportunities for frequency reuse. The BBC's view is that limiting the duration of spectrum licences in this way is unlikely to free up much spectrum, given that busy periods are likely to be broadly the same for all broadcasters. In addition, the BBC said that it may actually constrain operational flexibility – making it difficult, for example, to make changes to coverage based on (unexpected) results. The BBC says it believes that it is possible that any benefits will be outweighed by additional costs imposed.

A2.105 LOCOG said that this approach supports efficient spectrum use but will need very clear communication to spectrum users to avoid misunderstanding. It may also require heavier operational support in validating the users.

A2.106 SiSLive said that while this seems an attractive option it is likely to be of little practical benefit as the demand peaks for most RHBs will tend to coincide.

### **Ofcom's response**

A2.107 Ofcom accepts the force of these comments and will take them fully into account when developing the detailed assignment plan for licensing. We continue to believe that flexibility in licence assignments is desirable where justified by making it possible to meet spectrum demand more efficiently.

### **XXIX. The spectrum plan will be subject to change in the run-up to the London 2012 Games**

A2.108 The BBC said it assumed that the spectrum plan will be subject to change in the run-up to the London 2012 Games. It also said that the licensing process will need to strike the right balance between early allocation and flexibility to deal with changing requirements. The BBC suggested that an ability to appeal where unfavourable decisions are taken should also be included in the licensing process. Like the BBC, SiSLive said that the spectrum plan will certainly be subject to change in the run-up to the London 2012 Games and that the spectrum licensing process will need to strike the right balance between early allocation and flexibility to deal with late changing requirements. SiSLive suggested that while plans for host coverage may be set long in advance, demands from RHBs could be affected by the best stories of their nation's athletes. They asked that the ability to appeal against unfavourable decisions be included in the licensing process.

A2.109 LOCOG said that it supported Ofcom's approach to refine the spectrum plan to reflect key learning from test events and new technologies and that they believe that the most difficult area is defining the actual number of channels required noting that the requirement of sponsors has not yet been defined.

### **Ofcom's response**

A2.110 Key factors that might trigger changes to the spectrum plan include *inter alia*:

- the results of our monitoring activities;
- ongoing discussions with likely spectrum users at the London 2012 Games and day-to-day users;
- lessons learned from other comparable events, such as the Vancouver Games and the Delhi Commonwealth Games;
- lessons learned from test events;
- the development of the cultural-events programme;
- the broadcasting plans to be developed by OBS and RHBs;
- actual applications for spectrum;
- discussions with those applying for spectrum;
- technology developments; and
- changes to broader spectrum policy in the UK.

A2.111 Further information on licensing matters is given in Section 5.

### **Additional comments**

A2.112 BEIRG suggests that Ofcom should provide early clarity on which frequencies will be available for PMSE post-DSO and guarantees that the spectrum in question will remain available.

### **Satellite News Gathering**

A2.113 OBS drew attention to a requirement for SNG vehicles to transport video signals inside Olympic Park.

### **Ofcom's response**

A2.114 We have taken the requirement for SNG vehicles to transport video signals inside Olympic Park into our assumptions for spectrum demand and into our plans for licensing and interference management.

### **Non rights-holding broadcasters**

A2.115 A respondent commented that our assumptions would seem to apply in the main to rights-holding broadcasters who will be spending vast amounts to maximise the

return on their investment in event rights - both live and delayed. However, they point out that there will be thousands of non-rights holders both from the traditional and (even more than was the case in Beijing) new media who will be trying to tell the story of the Olympics from a perspective other than the sporting events themselves to which they have no access. The needs of these organisations should not be underestimated.

### **Ofcom's response**

A2.116 We recognise and acknowledge the importance of 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 because of the unique nature of the London 2012 Games, but not covered by the guarantees, are met and coordinated with day-to-day spectrum uses to the greatest extent possible.

### **Day-to-day requirements**

A2.117 Wembley National Stadium asked to see some reference to the need for Ofcom, LOCOG and event owners generally to recognise in the demand assumptions that venues such as Wembley Stadium, where "day-to-day" events will be taking place immediately before and after the London 2012 Games (and test events if appropriate), may require assumptions to ensure that the existing spectrum used in and around the stadium is not disrupted in any way. These modified assumptions should also reflect the needs of broadcasters and other parties that make use of spectrum on event days in the stadium.

### **Ofcom's response**

A2.118 We will endeavour to cause minimum disruption to those using spectrum on a day-to-day basis. At present, we do not anticipate revoking or varying licences during test events, but should our assessments of demand and supply change, we may need to do so.

A2.119 We may use test events to license spectrum users in a manner similar to our arrangement for the London 2012 Games. This will enable us to determine how best to undertake detailed assignment planning when licensing for the London 2012 Games themselves. We will certainly wish to test any new systems that are required well in advance of the London 2012 Games and may do so not only at test events but also on other occasions.

## **Question 10. Would you be willing to use LOCOG's land-radio network?**

A2.120 LOCOG will be encouraging all the Olympic Family and associated partners/contractors to use this network. This will, in LOCOG's view enable good spectrum usage, operational efficiency, reduction of the risk of interference and improve interoperability. LOCOG said that this service will be available via the Rate Card.

A2.121 The BBC and another respondent said they would be willing to use LOCOG's land-radio network, although the BBC said this would depend on the technical implementation of this network, and provided that the BBC have been able to test it over a reasonable period of time and at several major events in advance of the

London 2012 Games. Another respondent also would be willing to use it if it was London-wide and cost effective and had a certain guarantee of connectivity. Wembley National Stadium said that the availability of this network inside Wembley Stadium is unknown at the time of writing its response. OBS said that it and RHBs will be happy to discuss with LOCOG the potential use of such services once LOCOG announces all the technical, operational and financial conditions of this service and provided this service covers the needs of broadcasters, they believe that broadcasters will be happy to use it.

A2.122 RAYNET would not consider the use of LOCOG's land-radio network.

### **Ofcom's response**

A2.123 We take note of these responses and the willingness to use LOCOG's land-radio network. Ofcom has worked with LOCOG and the Government to ensure that spectrum is available for the network. It is our expectation that where requirements can be met from the LOCOG network stakeholders will adopt this solution.

### **Question 11. If not, how would you prefer to receive land-radio services?**

A2.124 The BBC said that it would in principle be willing to use LOCOG's land-radio network. However, they currently have equipment that operates on both licensed and licence exempt frequencies, which they would wish to use throughout the London 2012 Games. OBS said that all three options should be available:

- a LOCOG digital trunking system;
- radio through the LOCOG/Ofcom licensing scheme; and
- third party commercial networks.

A2.125 Wembley Stadium said that it has its own radio system.

A2.126 RAYNET said that it would continue to use the primary and secondary allocations to the Amateur and Amateur-Satellite Service.

### **Ofcom's response**

A2.127 We take note of these responses and the willingness to use LOCOG's land-radio network. We will take this into account in our developing assessment of demand for land radio services.

### **Question 12. Would you be willing to use CTCSS tones/DCS codes to allow the same channel to be used for land radio in both the Olympic Park and the River Zone?**

A2.128 The BBC said that it would not be happy to use CTCSS tones/DCS codes to allow the same channel to be used for land radio where this entails multiple use of single frequencies to provide talk-back and clean feed or cue. They said they would, however, be happy for this to be used for rigging, marshalling and security purposes, provided that it can be demonstrated that acceptable performance can be achieved at venues separated by a few kilometres.

- A2.129 LOCOG said that most telemetry channels use licence exempt spectrum, but it is very likely that some telemetry systems will require PMR licensed channels. This would be required to protect the channels that will be carrying data and could be constantly transmitting.
- A2.130 OBS said that it definitely would not be willing to use CTCSS tones/DCS codes to allow the same channel to be used for land radio in both the Olympic Park and the River Zone in the case of talkback systems and telecommand systems.
- A2.131 RAYNET said that should there be a need to allocate channels within the Amateur bands the implementation of CTCSS/DCS may be problematic since there is a great deal of legacy equipment in use which may not be capable of such operation.
- A2.132 Another respondent said they would not be willing to use CTCSS tones/DCS codes to allow the same channel to be used for land radio in both the Olympic Park and the River Zone and that based on past Olympics they would expect to have to use CTCSS/DCS. They said they would also prefer to use CTCSS to remove unwanted static breakthrough noise.
- A2.133 SiSLive recommend that specific tests are carried out to assess actual performance before any assumptions are made.

### **Ofcom's response**

- A2.134 Ofcom has no plans to introduce requirements for using CTCSS/CDS tones except where this is necessary on spectrum efficiency grounds e.g. to increase spectrum re-use.

### **Question 13. Do you have any other comments on our assessment and proposals for land radio?**

- A2.135 The BBC said that it uses PMR communications regularly as part of its heli-telly operations, and it expects this use to be more extensive during the London 2012 Games. JFMG said that it had noticed that the bands identified for PMR and talkback are almost identical apart from the inclusion of VHF frequencies for land mobile. JFMG said that this would be the obvious conclusion as equipment is often very similar. However, they said that they would suggest that those bands currently identified for PMSE use are retained for talkback and are only used for PMR in exceptional circumstances, as PMSE talkback users are used to these frequencies and are already equipped for them. Additionally JFMG said that maintaining this separation would also protect 'day-to-day' PMSE users. LOCOG said that they anticipate the demand for PMR spectrum to be high, around 450-470 MHz, and OBS said that a detailed description of the LOCOG digital trunking system would be a pre-requisite for any further analysis in this area. A respondent said a voice network around TETRA technology and on the Rate Card might be attractive to large organisations but only if it is priced cheaply.
- A2.136 Wembley National Stadium said greater consideration should be given to the existing radio systems as the "non-guaranteed" users rely on these for day-to-day business in venues such as Wembley Stadium. Wembley National Stadium said that it is essential that any systems deployed for guaranteed users do not interfere with existing systems in any way.

- A2.137 RAYNET said the fact that Amateur radio bands have been used in past Games is incongruous with the assumption that Ofcom does not anticipate revoking or varying existing licences to meet the requirements of the London 2012 Games. While Ofcom's stated preference is to meet demand in 137-173 MHz, the specific mention of the earlier use of 430-440MHz is concerning since existing Amateur licence conditions already exclude the use of 1MHz of this band within a 100km radius of Charing Cross. Any further variation would not be consistent with the desire not to revoke or vary existing licences.
- A2.138 RSGB note the potential use of the Amateur 144 MHz and 430MHz bands and look forward to more detailed discussion on this.

### **Ofcom's response**

- A2.139 Ofcom will consider whether we should hold back parts or all of those bands currently identified for PMSE use for talkback if the estimate of spectrum demand for land mobile radio changes our assessment significantly.
- A2.140 Ofcom will consider the requirement to use the primary and secondary allocations to the Amateur and Amateur-Satellite Service as it develops its venue-specific spectrum plans. We will continue to work closely with key stakeholders as we develop these plans. However, Ofcom does not currently anticipate revoking or varying existing licences to meet the requirements of the Games. In certain circumstances it might be necessary, but we think that such circumstances are likely to be very rare and we would endeavour to work closely with stakeholders to explore all options to accommodate both London 2012 Games and non-London 2012 Games use prior to taking such action.

### **Question 14. Do you have any comments on our assessment and proposals for maritime radio?**

- A2.141 LOCOG said that they would prefer the use of the Airwave TETRA network for the running of the sailing event. However, communications with boats and the coast guard and other support services may require maritime analogue channels. LOCOG therefore concurs with Ofcom's proposals at this stage. OBS said that maritime spectrum could be used for some coordination applications for the sailing event. However, they believe that talkback and telecommand systems will still need to operate in the standard PMR band.

### **Ofcom's response**

- A2.142 Ofcom will work with LOCOG, the MCA, the CAA, Emergency and Search and Rescue services, the OSD, the MOD, the Met Office and other users to develop a venue-specific spectrum plan for the sailing event. This work will include:
- a confirmation of our approach to the use of the LOCOG network for the running of the sailing event;
  - careful planning of any spectrum use in the 2700–3100 MHz band to ensure vital radar services are protected; and
  - ensuring that any use of spectrum above 406.1 MHz by the LOCOG network does not impact on the Cospas-Sarsat system. We do not plan to make

assignments to E&PSS or to the LOCOG network above 399.9 MHz and below 407.0 MHz.

### **Question 15. Do you have any comments on our assessment and proposals for wireless microphones and IEMs?**

- A2.143 The BBC welcomed Ofcom's decision to retain for use by wireless microphones and IEMs during the London 2012 Games the cleared Digital Dividend spectrum and as considered that as a result there is a strong likelihood that sufficient spectrum will be available for wireless microphones and IEMs.
- A2.144 BEIRG agreed with Ofcom's assumption that up to 350 wireless microphones and a further 100 IEMs will need to be accommodated in the Olympic Stadium during the opening ceremony of the London 2012 Games, but BEIRG does not share Ofcom's confidence that this number of applications will be able to be accommodated in UHF bands IV and V even if the cleared spectrum is held back from new use. BEIRG challenged Ofcom's assumptions concerning the availability of spectrum and provided a number of detailed arguments and supporting evidence for change to Ofcom's assumptions. BEIRG said that Ofcom's assessment of the ability to accommodate sufficient wireless microphones and IEMs at the Olympic Park is wildly optimistic.
- A2.145 BEIRG's arguments included the view that they wish to see the London switch over from analogue to DTT in April 2012 strictly adhered to in order that the spectrum that will comprise the UK's digital dividend (channels 31-35, 37 and 61-69) will be clear of analogue television for wireless microphones. BEIRG also sought an explanation for Ofcom's view on the availability of channel 29 for wireless microphones and IEMs.
- A2.146** JFMG sought clarification of the status of channel 42 on table 6 (p38) of the consultation, which shows the availability of UHF bands IV and V for wireless microphones and IEMs in the Olympic Park and on point 6.8 of Ofcom's consultation, which states that up to 320 MHz could be available in the Olympic Park particularly if Ofcom hold back rights of new use of the spectrum that will comprise the UK's digital dividend until after digital switchover. JFMG states that preventing access to the digital dividend for the London 2012 Games could have a significant impact on the spectrum plan and said that it is important for Ofcom to make a clear statement regarding availability for the London 2012 Games as several other documents have indicated that it would be, not just in London but throughout the whole of the UK.
- A2.147 JFMG also provided detailed comments on wireless microphone efficiency and the inclusion of consideration for high power (in the realm of 1W) wireless microphones or IEMs within the plan. They supported the view that the exclusion of channels 21 and 24 from use by wireless microphones should not cause any significant capacity issues, however they ask Ofcom to note that US visitors routinely use these channels for wireless microphones and IEMs.
- A2.148 LOCOG said that Ofcom will need to specify the test event spectrum plan as the Digital Switch Over is due to take place during test events as a result wireless microphone spectrum will change. OBS supported dense channel assignments and believe that it is important that existing equipment is sufficiently frequency agile to support any new bands.

- A2.149 SiSLive note that Ofcom's flexibility to accommodate demands for wireless microphones and IEMs is chiefly due to the DDR spectrum being retained for PMSE use until after the Games. They said they would also welcome a similar flexibility in other bands for example the band 2500-2690 MHz.
- A2.150 Wembley National Stadium said that from their experience, particularly during large events such as the FA Cup Final, it will be essential that the transmitter position is coordinated with the frequency they are allocated if the potential for interference is to be minimised and that the practicalities of achieving this level of coordination in the period leading up to an event are considerable due both to the physical constraints for available positions for transmitters inside the stadium and also the logistics of getting all users of spectrum for events to the stadium in advance of the event commencing. They suggest that Ofcom may wish to consider having a representative on site on and before an event day to assist with the coordination and to be in a position to make any last minute adjustments to licences that may be required to improve the use of spectrum during an event.

### Ofcom's response

- A2.151 Most wireless microphones will only operate in UHF Bands IV and V, sharing with analogue and digital terrestrial television. We said in the consultation that even modest improvements in the efficiency with which this spectrum is used compared to normal practice (e.g. as achieved during the London stages of the 2007 Tour de France) would ensure the peak demand of the Opening and Closing Ceremonies could be met with the spectrum which will be available. This will include the cleared spectrum available as a result of the switchover to DTT.
- A2.152 A key element of the capacity needed for wireless microphones will be the 790-862 MHz band (UHF channels 61-69). In the longer term Ofcom plans to clear this band of existing users – digital terrestrial television (DTT) and programme-making and special events (PMSE) – and award it as part of a more general award of frequencies envisaged in the Digital Britain implementation plan. However the band will be available for wireless microphones and IEMs until after the end of the London 2012 Games.
- A2.153 Our assumption that sufficient spectrum would be available for wireless microphones and IEMs was based on our knowledge of currently available technologies and the density with which they can be used. Some respondents (eg JFMG and OBS) supported this assumption; others (eg BEIRG) contested it. We will conduct further technical investigations to test and confirm our assumptions about what will be feasible. In the meantime we remain confident that the spectrum available will be adequate to meet peak demand for wireless microphones and IEMs.
- A2.154 Channel 29 had been identified for the sole geographic-interleaved (GI) award covering London. It is therefore not included as part of the band-manager award. Ofcom is considering whether to make channel 29 available for the London 2012 Games.
- A2.155 Ofcom confirms that channel 42 is available. Ofcom's table 6 on page 38 of the consultation document was in error. Ofcom wishes to encourage the use of agility in technologies where this is feasible to increase the likelihood that demand and supply of spectrum for the London 2012 Games can be balanced.

- A2.156 Channels 21 and 24 will be available at the Olympic Park for use for talkback and other higher-power audio applications.
- A2.157 Ofcom agrees that in exceptional circumstances, last-minute adjustments to licences may be necessary, and we plan to have the ability to do this at the London 2012 Games venues if necessary.

### **Question 16. Do you have any comments on our assessment and proposals for talkback?**

- A2.158 The BBC said that it is keen to ensure that the impact of its radio cars on the spectrum available for talkback is considered and confirmed that it makes extensive use of spectrum in UHF1 and 2 for local radio programme making using high power (25W) and bandwidths up to 50 kHz in vehicle-mounted systems. The BBC also confirmed that during the London 2012 Games they will want to continue to do this, as well as cover the London 2012 Games for their local radio network in England and the Nations, particularly as it is likely to prove extremely difficult to use GSM/ 3G devices, due to network congestion.
- A2.159 For any major event, the BBC and JFMG confirm that they are in close contact to ensure that both the BBC's and events' needs are met and that maintaining those bands currently allocated to PMSE for talkback use unless absolutely necessary for land mobile will simplify the process for both PMSE and business radio users alike.
- A2.160 The RSGB asked that we note that the amateur 70cms band (430-440 MHz) which they share (on a secondary basis) with the MOD is included in Table 8 of the consultation, which they share with MOD and that there is a significant amount of amateur repeater infrastructure in this band. For a variety of reasons therefore, the RSGB do not believe this band is a good choice.
- A2.161 SiSLive said that it is vital that all channels are checked for inter-modulation products as there will be many channels co-located. SiSLive's view is that the selection of inter-modulation product-free frequency pairs is a complex exercise but a vital one and that, at any given venue, it will make the difference between a satisfactory service and a very poor service.

### **Ofcom's response**

- A2.162 Ofcom notes the use of UHF1 and 2 for local radio programme making using high power (25W) and bandwidths up to 50 kHz in vehicle-mounted systems. With key stakeholders we will review the spectrum demand for mobile local radio programme making equipment and revise our spectrum plan as necessary. Ofcom will also work with key stakeholders as it develops venue-specific spectrum plans that take into account the requirements of day-to-day spectrum uses. Ofcom will put in place monitoring and enforcement arrangements to support its plans.
- A2.163 Ofcom will consider the requirement to use the primary and secondary allocations to the Amateur and Amateur-Satellite Service as it develops its venue-specific spectrum plans. We will continue to work closely with key stakeholders as we develop these plans.
- A2.164 Any further studies, including those related to the co-siting of antennas, that Ofcom undertakes into the parameters of stations, including any practical testing, will be taken into account in our plans in advance of the London 2012 Games.

## Question 17. Do you have any comments on ADS?

A2.165 LOCOG commented that the ADS allocation will not suffice as it is currently limited to only 4 channels (channels at 61.2, 61.7, 62.3 and 62.7 MHz) with a 1W output maximum. Wembley National Stadium said that Ofcom should take into consideration those ADS frequencies already in use at existing venues.

### Ofcom's response

A2.166 Spectrum for Live ADS will be available so that everyone, including blind and partially sighted people, will have equal access to the Games, including the Opening and Closing Ceremonies, torch relays and medal ceremonies. In order to plan for this we need LOCOG and the ODA to define their requirement for Live ADS, including that needed for the cultural events.

A2.167 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, subject to coordination with the MOD.

## Question 18. Which bands would you prefer to use for wireless cameras?

A2.168 Most responses identified that the use of bands between 2000 MHz and 4000 MHz was preferred for wireless cameras because frequency bands in this range have suitable propagation characteristics particularly for coverage of events taking place over wide areas, such as the marathon, rowing and sailing. The BBC also mentioned that they already have (or can readily hire) equipment which works in these bands.

A2.169 LOCOG and SiSLive identified that spectrum in the 6000 MHz to 10 GHz range is used regularly and there is large installed base of equipment among UK operators. LOCOG mentioned the use of equipment in this range by Japanese broadcasters.

A2.170 OBS provided a more general answer about the scale of their requirement, highlighting the need to be able to use all bands that satisfy conditions with regard, for example, to quality, and availability of equipment. OBS also highlighted concerns about the availability of sufficient spectrum for the channels required for the coverage of the Outside Races, particularly in the case where it may be mandatory to use 20 MHz bandwidth.

A2.171 The RSGB notes that a number of these bands overlap with amateur microwave use and seek further discussion in this regard.

### Ofcom's response

A2.172 Ofcom believes that we can satisfy demand for spectrum for wireless cameras at frequencies commonly used by broadcasters and/or for which equipment is readily available – i.e. 2000 MHz to 4000 MHz, and 7000 MHz. There is also the possibility of making other, higher-frequency, spectrum available to those who are willing and able to use it. We will continue to work closely with broadcasters and manufacturers to encourage this.

A2.173 The BBC requested in its response that Ofcom should reserve the 2600 MHz band for wireless camera use during the London 2012 Games. The Digital Britain report envisages this band being awarded to new users at an early date; and it appears that other bands will be adequate to meet expected demand for wireless camera spectrum. Ofcom therefore does not expect to need to reserve it for wireless camera use in 2012. We will, however, keep this position under review.

A2.174 Spectrum within the bands 2700-3100 and 3100-3400 MHz will be made available for wireless cameras at the London 2012 Games and Ofcom considers that access to the 3400-3600 MHz, which is managed by the MOD and forms part of the MOD's holdings and its spectrum reform programme, a high priority, but assignments in all these bands for wireless cameras will be subject to some technical conditions and geographic restrictions for interference management reasons. In particular:

- The 2700-3100 MHz band is shared by the CAA with the MOD and the MCA for radars and includes a requirement for Met Office meteorological radars. Ofcom continues to work with these organisations to release capacity within this band.
- The 3100-3400 MHz band is managed by NATO and used for essential military land, airborne and naval radars. Capacity within it will be made available for wireless cameras at the Olympics, subject to certain technical conditions.
- The 3400-3600 MHz band was not included in the consultation because it forms part of the MOD's Defence Spectrum Strategy and is scheduled for release by the MOD before 2012.

A2.175 Ofcom will consider the requirement for allocations to the Amateur and Amateur-Satellite Service as it develops its venue-specific spectrum plans. We will continue to work closely with key stakeholders as we develop these plans.

### **Question 19. Which bands would you be willing to use for wireless cameras if you cannot use your preferred bands?**

A2.176 Another respondent said that they would not want to be forced to hire or acquire new equipment specifically for this event and reiterated their earlier comments that they would hope to be able to be provided with a London-wide wireless camera frequency for use both inside and outside the Olympic Park, but not within any specific venues, so that they could turn up and deploy newsgathering operations at short notice, and that their equipment works within the 2000 to 3000 MHz range.

A2.177 The BBC said that if the bands mentioned in their response to Question 18 are not available they would wish to use bands immediately adjacent, given their similar propagation characteristics and the fact that they already have (or can readily hire) equipment which works in these bands. They would also consider using spectrum at 7000 MHz for 'more fixed' events, such as those within stadia. SiSLive echoed the BBC's view and said that the laws of physics determine the relative performance of the various bands, but if first choice bands are not available then the alternative offer must be as close as possible in frequency.

A2.178 Another respondent said that they could not justify the capital expenditure for something that would really only be useful to them during the period of the London 2012 Games.

## Ofcom's response

A2.179 Ofcom believes that we can satisfy demand for spectrum for wireless cameras at frequencies commonly used by broadcasters and/or for which equipment is readily available i.e. 2000 MHz to 4000 MHz, and 7000 MHz. There is also the possibility of making other, higher-frequency, spectrum available to those who are willing and able to use it. We will continue to work closely with broadcasters and manufacturers to encourage this.

## Question 20. Do you have any other comments on our assessment and proposals for wireless cameras?

A2.180 Comments on this question largely echoed those for questions 18 to 20 and the desire to see spectrum made available in the 2000 MHz to 4000 MHz frequency range for wireless cameras. However JFMG and OBS mentioned that Ofcom's forecast for airborne demand was on the extremely conservative side.

## Ofcom's response

A2.181 Based on the experience of the Beijing Games, we had forecast demand for three airborne wireless channels in simultaneous (co-coverage) use, but a better estimate of demand is likely to emerge later this year when the results of the survey of the aviation sector's requirements is completed by the Department for Transport's Aviation Stakeholder Group. Additional spectrum for airborne wireless cameras may be available if spectrum from within the 3400–3600 MHz band becomes available. There are a number of bands available for airborne use and further spectrum may become available. See table 9 in Section 4.

## Question 21. Which bands would you prefer to use for point-to-point links?

A2.182 BBC expressed a strong preference to use the bands that they currently have access to, given their propagation characteristics and the fact that they already have (or can readily hire) equipment that works in these bands. Spectrum from 5000 MHz to 12 GHz range is generally suitable for point-to-point links and equipment is readily available in the existing bands (e.g. 5472-5925 MHz, 7110-7425 MHz, 8460-8500 MHz, 10.3-10.6 GHz, 11.736-11.997 GHz, 12.2-12.5 GHz).

A2.183 SiSLive also said that they have a strong preference to use the same bands as are used for day-to-day. They noted that 7000 MHz is used regularly and there is a significant amount of suitable gear available in this band. They also said that the band from 12.2-12.5 GHz is attractive as a wide allocation not normally required for mobile applications, but there is a risk of interference to satellite TV services and other Ku band downlinking. For this reason Sislive would like to see this band not used for fixed links.

A2.184 The BBC said that the band from 12.2-12.5 GHz is attractive as a wide allocation not normally required for mobile applications, but there is a risk of interference to satellite TV services (DVB-S) which normally precludes its use. Careful planning and coordination with other satellite services will be necessary since satellite LNBs tend to be designed to maximise G/T and can be quite vulnerable to interference from point-to-point links.

A2.185 OBS commented that they will be happy to use the highest frequency with guaranteed transmission characteristics, subject to equipment availability, path lengths and required diversity.

### **Ofcom's response**

A2.186 BBC identifies the 5472-5925 MHz, 7110-7425 MHz, 8460-8500 MHz, 10.3-10.6 GHz, 11.736-11.997 GHz, 12.2-12.5 GHz bands, however these are not UK Fixed Service point-to-point bands. The band 14.25-14.5 GHz is a closed UK band i.e. no new links are assigned in this spectrum only legacy links remain.

A2.187 We will pre-coordinate 14/11 GHz for SNG operation at the known London 2012 Games venues in advance, which should identify any constraints with respect to FS links and MOD/CAA. These assessments will consider FSS ES transmit into FS links. There is no need for assessment of FSS interference into FSS downlinks at 11 GHz.

A2.188 It should be noted that there are some pre-existing FS links operating at 11 GHz and these may impose constraints on FSS downlink operation. This will be captured in the pre-coordination exercise.

### **Question 22. Which bands would you be willing to use for point-to-point links if you cannot use your preferred bands?**

A2.189 The BBC once again mentioned that if the bands noted in their response to Question 21 are not available for use, they would wish to use bands immediately adjacent, given their similar propagation characteristics and the fact that the BBC already have (or can readily hire) equipment which works in these bands.

A2.190 The BBC also mentioned that operation at higher microwave frequencies (24.25-24.50 GHz or 48.0-48.4 GHz) may be possible, but equipment tends to be susceptible to precipitation losses (and is more expensive).

A2.191 SiSLive said that it must be borne in mind when licensing bands specially freed up for the London 2012 Games that if capital equipment has to be purchased that cannot be licensed for subsequent use in the UK then costs will be prohibitive. Manufacturers will probably endeavour to be helpful with modification and retuning of new gear but capital items such as antennas, filters and combiners will have to be fully funded for the London 2012 Games alone. This would result in an unreasonable cost burden on members of the Games family. Instances of this sort must be kept to an absolute minimum and discussed with licensees well ahead of time.

### **Ofcom's response**

A2.192 Ofcom acknowledges that using bands unique to the London 2012 Games, which require capital investment for that alone, should be minimised. We will take this into account so far as possible in creating the assignments for these links.

### **Question 23. Do you have any other comments on our assessment and proposals for point-to-point links?**

A2.193 The BBC mentioned that additional bands not normally allocated to PMSE, which are not adjacent to bands currently used, may be difficult to use due to the poor

availability of suitable equipment. Once again, the BBC said spectrum users are unlikely to be willing to invest in equipment that has no commercial application after completion of the London 2012 Games.

A2.194 The BBC also said that they believe that the extent to which alternative solutions such as free-space optics can reduce the requirement for point-to-point links is extremely limited. SiSLive's assumptions are broadly in line with the BBC's view that the utility of free-space optics is likely to be insignificant, as are the views of Wembley National Stadium, who agreed with our overall assessment that optical fibre has generally replaced the need for point-to-point links for high speed data links in the majority of venues. However, Wembley National Stadium do foresee a potential need for point-to-point links for "last minute" situations where the data link between the stadium and an adjacent OB compound may be delayed.

### **Ofcom's response**

A2.195 Ofcom will take these comments into account so far as possible in making assignments.

### **Question 24. Do you have any comments on our assessment and proposals for FSS?**

A2.196 Another respondent said that consideration may be required of the demands for the deployment of Satcom "on the move" terminals and requested a general clearance for mobile uplinks within the M25 ring road to enable fast and simple deployment of SNG units to any location considered news worthy. Attached to this would be a corresponding general clearance for use of a wireless camera unit, they suggest.

A2.197 The BBC and SiSLive said that they believe that Ku band down-linking will be a vital part of many sub-systems used by OBS and RHBs (and the public). As such, they believe that Ofcom should not make any allocation during the Games that could interfere with Ku-Band down-linking at 10.7-12.75 GHz at any London 2012 Games location.

A2.198 LOCOG said that they anticipate the need for broadcasters to use transportable Earth Stations in C-Band. OBS asks whether we anticipate issues regarding the use of C-Band in the area of the IBC.

### **Ofcom's response**

A2.199 There are some pre-existing FS links operating at 11 GHz and these may impose constraints on FSS downlink operation. This will be captured in the pre-coordination exercise.

A2.200 The FWS band at 10.7-11.7GHz is a closed band i.e. no new FS assignments can be made. Ofcom will not authorise new FS assignments in the 10.7-11.7 GHz band for the London 2012 Games.

### **Question 25. Do you have any comments on our assessment for MSS?**

A2.201 The BBC said that it uses MSS extensively in order to provide coverage from around the globe, especially when terrestrial telephone networks are congested. The BBC hopes to use MSS throughout the period of the London 2012 Games.

## Ofcom's response

A2.202 Spectrum for MSS is already available with restrictions on certain locations only when absolutely necessary, both inside and outside the Olympic Park. Spectrum for MSS is subject to international notification and coordination. Ofcom does not plan to make further spectrum available for MSS for the London 2012 Games.

## Question 26. Do you have any comments on our assessment for RNSS?

A2.203 LOCOG noted that the MOD occasionally conducts tests on military systems that may result in some loss of service to civilian users of the Global Positioning System (GPS) including in-car navigation devices and networks, which rely on GPS signals. LOCOG anticipates heavy use of GPS technologies for timing purposes and request that no GPS jamming exercises, which could interfere with their applications, are carried out during the London 2012 Games.

## Ofcom's response

A2.204 Ofcom will request through the relevant government committee that no GPS jamming exercises are carried out during the London 2012 Games.

## Question 27. Do you have any comments on our assessment and proposals for telemetry and telecommand?

A2.205 The BBC and SiSLive said that despite identifying a requirement for fifty telemetry channels in the Olympic Park, Ofcom does not seem to have suggested any licensable (exclusive-use) channels. The BBC and SiSLive do not believe that licence exempt channels are acceptable for data control of most wireless cameras used by the host broadcaster. This is because control of live cameras requires a very fast response time, which cannot be achieved on a contended channel. There are currently only fifteen camera data channels licensable through JFMG. In making licensable channels available the BBC said that it should be noted that the data receivers are necessarily compact and lightweight because they are attached to a mobile camera and, as such, are limited in terms of selectivity. SiSLive said that there are currently only 12 camera data channels licensable through JFMG.

A2.206 JFMG said that wireless cameras also require telecommand channels to adjust settings from the production area and these are traditionally situated in 462 MHz (and also 473 MHz in London). However, JFMG noted that these licensed frequencies are not mentioned in the plan for telemetry and in addition that some telecommand channels are located in channel 21, where only land mobile and talkback use is proposed to be allocated. JFMG suggest therefore that the use of licensed channels for telecommand be included in future iterations of the plan. Similarly, OBS drew attention to telecommand for camera remote-control within "PMR" frequencies (in the 400 MHz bands). OBS said that they expect that these frequencies will be fully managed by the same processes that are established for the rest of the London 2012 Games spectrum and that they do not believe that a "license-exemption" approach is appropriate to such use.

A2.207 LOCOG noted that IR2030 offers a wide range of bands that will meet some of their requirements assuming there are enough channels available. LOCOG asks whether Ofcom allow higher powers to be used in IR2030 bands.

A2.208 RAYNET expressed concern that interference constraints in the band 433.05-434.79 MHz from existing licence exempt, Amateur and MOD uses are not considered.

A2.209 Wembley National Stadium said that their preference is that telemetry and telecommand users are moved away from the licence exempt band (2400 MHz) so as to avoid the potential for interference with WLSN systems that already exist inside existing venues such as Wembley Stadium.

### **Ofcom's response**

A2.210 Ofcom notes that in some cases PMR devices could be used to carry data and that this may often be the case for telemetry applications, which do not use licence exempt spectrum. When necessary we will make spectrum available for telemetry on an exclusive basis within the Olympic Park as part of our venue-specific spectrum plan.

A2.211 Ofcom will consider whether there is a requirement to use the primary and secondary allocations to the Amateur and Amateur-Satellite Service as it develops its venue-specific spectrum plans. We will continue to work closely with key stakeholders as we develop these plans.

### **Question 28. Do you have any comments on our assessment and proposals for WLANs?**

A2.212 The BBC said that the difficulty in controlling the use of Bluetooth, video senders, microwave ovens and other 2400 MHz ISM band equipment should not be underestimated and noted that there is a small possibility of interference between 802.11a WLANs and wireless cameras using the 5000 MHz bands. The BBC said that this interference can be minimised by careful planning, paying particular attention to WLAN access point installations and limiting the deployment to indoor locations wherever possible. OBS said that RHBs may have an expectation of setting up their own wireless LANs at venues and the IBC. Encouraging the use of 5G and co-ordination of channels may be helpful.

A2.213 The BBC drew attention to other potential sources of 5000 MHz interference including 802.16d/e equipment deployed in the 5000 MHz ISM band. LOCOG identified that it may wish to consider using the 5000 MHz WLAN band (IEEE802.11a) for applications where availability of 2400 MHz capacity fails due to congestion or interference. JFMG said that Vancouver's approach to WLANs appears to have merit and supported the exclusion of 2400 MHz WLAN equipment in venues to minimize potential interference to other services. The RSGB said that they are aware of Ofcom's research on WiFi congestion in urban areas and agree that care must be taken, bearing in mind that the standard WiFi bands also have some licensed Amateur and Amateur Satellite use as well.

A2.214 LOCOG said that they were minded to offer good quality wireless internet services to their customers and that they will be providing services to press and media in specific areas for work purposes via their Rate Card system. Over the coming months, they will be finalising their strategy for members of the Olympic Family and general public.

A2.215 Wembley National Stadium operates an Airspace Management Process that forbids the deployment of any WLAN systems within the Wembley Stadium demise. Event

owners are encouraged to make use of the extensive WLAN system that exists inside the stadium and which is managed by the Wembley Stadium IT team. On the rare occasions when this is not possible or feasible, Wembley Stadium said that event owners can deploy their own local WLAN system but this is strictly coordinated by the IT team to ensure interference is kept to a minimum.

A2.216 The Met Office said that WLANs operating in the 5600-5650 MHz meteorological radar band can potentially cause serious interference to the weather radars operated by the Met Office and that this can compromise the Met Office's ability to predict and monitor severe weather events that threaten the safety of life and preservation of property. Meteorological radars will therefore have an important safety role during the London 2012 Games as well as providing information on weather conditions that could have significant implications for the organisers and for those attending the London 2012 Games.

A2.217 Reference is made in the consultation document at paragraph 4.16 to a requirement that all wireless equipment should comply with the relevant ETSI standards. The Met Office said that it is particularly important that RLAN devices operating in the 5600- 5650 MHz band conform to the latest standard EN 301 893 (currently v1.5.1) as the earlier versions of this standard do not provide sufficient protection to meteorological radars. The Met Office said that the recent changes to the ETSI standard should provide a greater level of protection to meteorological radars from RLAN devices that conform to it and that it will be important that the use of RLAN devices that do not conform to the latest ETSI standard should be prohibited.

A2.218 The Met Office is also concerned as to how effective DFS will be when large numbers of RLANs are deployed in relatively small areas. This effect is also referred to at paragraph 13.13 of the consultation document. Furthermore, when interference has occurred it has taken Ofcom a significant amount of time, up to a month, to detect and eliminate the sources. Clearly, more effective measures will be needed during the London 2012 Games.

A2.219 For the above reasons the Met Office requests that:

- all RLAN devices to be used for the London 2012 Games be registered, despite their licence exempt status. Registration should include a declaration that the devices conform to the latest ETSI standard;
- the density of deployment of RLANs be limited in particular venues; and
- a rapid response capability should be provided to track down and eliminate RLANs that cause interference to radar.

## **Ofcom's response**

A2.220 Certain equipment may be exempted in the UK from the requirement to be licensed under the Wireless Telegraphy Act 2006 because its use is not likely to cause harmful interference. Experience from past Games has shown, however, that the unusual concentration of such equipment in particular venues can create the potential for localised harmful interference.

A2.221 We are exploring with LOCOG how such use can best be controlled and/or 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. We understand that LOCOG is developing a strategy for WLAN use in London 2012 Games venues and we will take this into account when further developing our plans for managing licence exempt spectrum.

A2.222 Ofcom understands the Met Office's concern to protect the use of its radars and the importance of the information that these radars provide to the London 2012 Games. Ofcom will carry out a detailed study of the protection of Met Radars from WLANs and take this into account in our venue-specific plans.

### **Question 29. Do you have any comments on our assessment or proposals for spectrum at the six football venues?**

A2.223 The BBC believes that the allowance of two channels for wireless cameras may on occasion be insufficient. They request that frequency coordination at these more distant venues be handled by the same authority as for closer venues. SiSLive agree with the BBC's view.

A2.224 JFMG agreed that there is unlikely to be any spectrum congestion issues at the six football venues identified for the London 2012 Games. They note that whilst there is still a considerable amount of spectrum use for comparable large events such as the FA Cup Final and the Champions League Final, demand can usually be met by coordinating requirements in advance and developing a detailed understanding of the characteristics of the venue. They suggest that a detailed understanding of these venues can be ascertained by undertaking a technical survey of the ground in advance of the event.

A2.225 JFMG highlighted that matches are accompanied by corporate VIP events held in stadium conference facilities and that these further increase the demand for spectrum, in particular for wireless microphones and stage intercom systems. JFMG said that this additional requirement can increase the overall demand by as much as 50% and, although these are not currently included in Ofcom's estimates, JFMG do not anticipate any difficulties in accommodating the overall demand.

A2.226 Spectrum use within football stadiums will be strictly managed JFMG said, as it can sometimes be disturbed by users just outside the venue. They believe that it is important to ensure that all users' requirements including non rights-holding visitors, are taken account of and strictly controlled and that it will be necessary to ensure onsite attendance to address this issue. JFMG question Ofcom's proposal for exclusion zones for the 6 football venues as excessive.

A2.227 LOCOG notes that our assessment is based on spectrum demand per venue at only one time. They said that in reality the Olympic Family would expect to have to be able to use the same channels every time they visit the venue. As a result the aggregated demand is higher than stated. The RSGB believe such venues are used to handling major events and do not require significant amounts of additional spectrum

A2.228 Wembley National Stadium concurs with the statement that football venues such as Wembley Stadium are unlikely to have greater spectrum requirements for the London 2012 Games than for a large number of normal events that take place inside the stadium and confirmed their view that the number of PMR channels allocated does appear to be adequate, although they said that the full requirements for coverage area and number of users in and around the stadium for the London 2012 Games are unknown at present.

A2.229 Wembley National Stadium said that the ability of LOCOG to overlay its own PMR network over the existing system at Wembley is unknown and said that any comprehensive changes to the radio system at the stadium will need to be planned well in advance (in 2010) so that any work required on the infrastructure is carried out when there are no day-to-day events scheduled to take place in the stadium. Wembley National Stadium drew attention to the Champions League Final, which is scheduled to take place at Wembley Stadium in May 2011. They anticipate that the scale of the overall spectrum requirements for an event of this size will dwarf anything seen to date in the stadium and suggest that Ofcom may consider this to be a good “test” situation for the processes and procedures they propose to adopt for spectrum allocation and management at the London 2012 Games.

### **Ofcom’s response**

A2.230 Ofcom notes the BBC’s view that the allowance of two channels for wireless cameras may on occasion be insufficient. Ofcom plans to offer licences that will allow for London-wide camera use both inside and outside the Olympic Park within the 2000 to 4000 MHz range, subject to constraints only when needed. We will consider the availability of spectrum in bands below 10 GHz, such as 7000 MHz, for the use of specific wireless cameras, as well as bands above 10 GHz, when we develop venue-specific spectrum plans.

A2.231 Ofcom will consider using the Champions League Final, scheduled to take place at Wembley Stadium in May 2011, to test and verify the processes and procedures that are in development for managing the spectrum plan for the London 2012 Games.

A2.232 In order to obtain a detailed understanding of the requirements for specific venues Ofcom will undertake a series of technical surveys. Ofcom will take measurements to ascertain the level of interference received into the venue from elsewhere as well as the level of radio signal that travels outside the venue into the neighbouring area.

A2.233 Ofcom will work with key stakeholders to review the spectrum demand for specific venues. This will include a review of the need for exclusion zones at certain venues.

### **Question 30. Do you have any comments on our assessment and proposals for cultural events?**

A2.234 The BBC said that it broadly agrees with Ofcom’s assessment and proposals. However, it urged Ofcom to make clear as early as possible which events will be licensed on a “day-to-day” basis and which fall within the scope of the Government’s spectrum guarantees. The BBC said that it welcomed Ofcom’s statement in paragraph 10.17 of the consultation that it “... will be ready to work with the organisers to identify how their spectrum needs might be met.” They noted, however, that Ofcom does not have control over all of the bands with which such spectrum needs might be met.

A2.235 JFMG said that it is likely that peak demand and therefore capacity issues will be most significant during the course of the actual London 2012 Games’ themselves. It would therefore follow that cultural events in the run up to the London 2012 Games, whilst generating significant demand, should be catered for without relying unduly on the additional spectrum Ofcom has identified. It should be possible to accommodate the events that occur across the country whilst also ensuring non-London 2012 Games events aren’t adversely affected. JFMG also said that there

may be a requirement to access additional spectrum for cultural events that occur during the London 2012 Games in some locations, especially those in close proximity to the London 2012 Games venues themselves and that borrowing spectrum from other owners is unusually common practice for PMSE. JFMG said that it often require permission to use additional spectrum for large annual events, especially where parties are traveling from abroad and therefore hope that Ofcom would not discount this possibility.

- A2.236 OBS said that it anticipates that a domestic broadcaster would have an enhanced interest in these cultural events, but noted the lack of information on the planned events.
- A2.237 Given their nature JFMG assume that these cultural events will be catered for by the band manager with obligations to PMSE users and charged the market rate associated with PMSE access at the time.
- A2.238 Regarding 'Other events and celebrations', JFMG mentioned that the Olympic and Paralympic torch relays are covered by the Government guarantees and agrees that their spectrum requirements can be catered for on a day-to-day basis, but said that it raises some queries regarding how this particular use would be dealt with. JFMG notes that the relays will be traveling the UK in the build up to the London 2012 Games and will utilize existing available spectrum. JFMG believe that it will therefore be necessary to coordinate their spectrum usage with normal PMSE use as they make their journey and that this could be difficult as the short-term nature of PMSE means the spectrum usage landscape is dynamic and subject to change at a moment's notice. JFMG said that it would be necessary for the band manager with obligations to PMSE users issuing regular PMSE licenses and Ofcom to share up-to-date information on requirements and usage to ensure no disruption was caused to either area of use.
- A2.239 JFMG said that it firmly believes that in order to effect a successful Games both London 2012 Games and non-London 2012 Games use needs to be fully catered for and that it believes the only way of being sure that the day-to-day business of PMSE users is not affected is by enabling full coordination of both requirements. Whilst the London 2012 Games is an amazing opportunity for the UK, JFMG said, a one-off event should not result in unrelated PMSE activity being harmed and only by being aware of the totality of requirements; existing usage in an area; by having expert knowledge of PMSE; event planning and management can spectrum utilisation be maximised and the integrity of all events and uses be achieved.
- A2.240 Wembley National Stadium said that it concurred with Ofcom's view of the importance of effective planning of "day-to-day" events in the period leading up to the London 2012 Games. Wembley Stadium expect to continue to liaise closely with event organisers and encourage them to obtain the correct licences from the relevant party for spectrum that is required for their events in the stadium and that it believed it necessary to do this further in advance than normal in the lead up to the London 2012 Games.
- A2.241 SiSLive said that it believes that whether or not a particular activity is covered by the guarantee, the frequency management of cultural events will need to be done by a single agency, in close consultation with the band manager with obligations to PMSE users. The effective joining up of the London 2012 Games spectrum with 'day-to-day' spectrum cannot be done in any other way.

- A2.242 LOCOG said that it believed that the Torch relay could be complex and that the road show will include local broadcasting teams, accredited rights holders and non-rights holders. In LOCOG's view the current proposal to license some of these groups via a different process could cause confusion and increase the risk of radio interference.
- A2.243 RAYNET said that it is possible that it may be asked to support those User Services identified in the Amateur licence, which include the Voluntary Aid societies, St John's Ambulance and the Red Cross. RAYNET said that it expected that it would meet the spectrum requirements for these events from Amateur allocations in the 144-146 and 430-440MHz bands in a 'day-to-day' environment. RAYNET said that the majority of the channels in use are already identified in the Amateur band plan; where talkthrough units are involved then certain non-standard frequencies may be used to provide security from interference at times. The degree of this usage has been identified to Ofcom in the two reports on talkthrough usage submitted to Ofcom in previous years.

### **Ofcom's response**

- A2.244 Ofcom will test its spectrum plan at a number of special events prior to the London 2012 Games. We will use the information obtained from these events to improve and refine our spectrum plan and develop venue-specific plans where these are needed.
- A2.245 Current procedures for accessing spectrum needed during the London 2012 Games in some locations, especially those in close proximity to the London 2012 Games venues themselves, will be enhanced and Ofcom is developing a licensing process that will provide flexibility to deal with changing requirements.
- A2.246 Spectrum for the Olympic and Paralympic torch relays will be sought from the normal sources for such events. In the case that these are not sufficient the spectrum bands set out in this plan may be called on to supplement availability.
- A2.247 Ofcom will continue to work with key stakeholders as it develops the spectrum plan and spectrum plans for specific venues.

### **Question 31. Do any non-guaranteed public services have spectrum requirements that cannot be met through existing allocation and assignment processes?**

- A2.248 There were no responses to this question.

### **Question 32. Do any non-guaranteed private services have spectrum requirements that cannot be met through the market and existing assignment processes? Should we make alternative arrangements for handling such requests?**

- A2.249 JFMG said that it had no specific concerns regarding non-guaranteed spectrum requirements as long as there is sufficient collaboration between Ofcom's London 2012 Games licensing team and the band manager with obligations to PMSE users. JFMG also said that it believed that treating PMSE use as a whole would minimise the likelihood of spectrum requirements from users such as non-rights-holding

broadcasters being unsatisfied. It might also negate any requirement to implement exclusion zones around London 2012 Games venues.

A2.250 OBS said that it disagreed with Ofcom's placement of the potential WCATV requirements in this category. In OBS's view the WCATV requirements, if any, will need to be handled through the same approach as other spectrum requirements for the London 2012 Games and governed by the same availability guarantees. In this regard, it also noted that the WCATV solution is the extension of an existing solution, available in all Summer and Winter Games since Athens, to use venue FM transmissions for similar purposes. OBS said that FM venue transmissions will, most probably, also be required for the London 2012 Games and they should also be covered by the same guarantees as the other spectrum requirements for the broadcast operations of the London 2012 Games.

### **Ofcom's response**

A2.251 Ofcom will provide the spectrum required for the London 2012 Games to meet the Government guarantees and will grant licences to use that spectrum. It will monitor spectrum use and enforce interference management. Ofcom will therefore manage spectrum for the London 2012 Games and for our day-to-day customers.

A2.252 Ofcom will provide the spectrum required for potential WCATV requirements under the guarantees.

A2.253 Respondents to the consultation made important observations about the need for proper provision of licensing arrangements for both Olympic Family members and other stakeholders. They also noted that such arrangements should avoid the inconvenience and confusion that could arise from requiring stakeholders to seek spectrum authorisation from a number of different sources. Dealing with these issues would require effective cooperation between Ofcom and the new band manager with obligations to PMSE users<sup>51</sup>, which will replace our current licensing arrangements for PMSE and about the arrangements for which we have recently consulted.

A2.254 Respondents to the most recent consultation, which closed on 7 September 2009, have provided valuable input on licensing issues for the London 2012 Games. Until we have fully considered both sets of responses we believe it inappropriate to reach a definitive view about licensing arrangements for the London 2012 Games for all stakeholders. We will set out our conclusions on the licensing arrangements for the London 2012 Games in due course.

### **Question 33. Do you have any comments on our approach to innovation and legacy?**

A2.255 The BBC believes that Ofcom's approach to innovation and legacy seems sensible and RAYNET said that it welcomed Ofcom's proposal (at paragraph 12.5 of the consultation), though some provision should be made to ensure that any equipment imported to meet the needs of the London 2012 Games which does not comply with normal UK frequency usage is removed from the country at the end of the London 2012 Games.

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<sup>51</sup> <http://www.ofcom.org.uk/consult/condocs/bandmgr/condoc.pdf>

## Ofcom's response

A2.256 We have agreed with the Government that its spectrum guarantees do not extend beyond the end of the London 2012 Games and so do not cover legacy. Spectrum temporarily made available by UK public sector bodies will be returned to them once the London 2012 Games requirement has ended. Thereafter, new spectrum will need to be secured through existing allocation and assignment processes or through the market.

### **Question 34. Do you agree we should establish special licensing arrangements for users covered by the Government's spectrum guarantees? To what extent is your response based on what has worked well at past Games and comparable events?**

A2.257 There was general agreement and approval for Ofcom's proposal to establish special licensing arrangements for users covered by the Government's spectrum guarantees. This was identified as standard and best practice at previous events, and provided a practical way of ensuring that the special arrangements necessary for applications from Olympic Family members could be applied effectively. Respondents also recognised the need to have licences and spectrum authorisations that were designed to meet the specific requirements of radio use at the London 2012 Games.

A2.258 A number of respondents raised issues relating to our proposals to provide separate licensing arrangements for use covered by the Government's guarantees, and spectrum use not covered by them. Respondents highlighted:

- the need for non-guaranteed users covering or in some way involved in the London 2012 Games to have suitable arrangements for obtaining spectrum access; a number of respondents suggested that the special arrangement be extended to all users;
- the need to ensure that it was clear to all stakeholders how they could obtain spectrum access, and that this arrangement didn't require stakeholders to liaise with multiple organisations. Respondents also identified the benefits of licensing arrangements which supported operational flexibility in providing coverage from outside venues and in the wider host city; and
- the importance of close liaison between all organisations managing spectrum during Games time, and particularly between Ofcom and the new band manager with obligations to PMSE users who will be responsible for authorising much of the non-guaranteed PMSE activity expected at Games time. One respondent highlighted the importance of effective information sharing between such organisations in order to maximise the efficient use of the available spectrum and re-use of spectrum.

## Ofcom's response

A2.259 Ofcom confirms that special licensing arrangements will be established for the London 2012 Games and applications from users covered by the guarantees will be received through the LOCOG Rate Card system.

- A2.260 Respondents to the consultation made important observations about the need for proper provision of licensing arrangements for both Olympic Family members and other stakeholders. They also noted that such arrangements should avoid the inconvenience and confusion that could arise from requiring stakeholders to seek spectrum authorisation from a number of different sources. Dealing with these issues would require effective cooperation between Ofcom and the new band manager with obligations to PMSE users<sup>52</sup>, which will replace our current arrangements for PMSE and about the arrangements for which we recently consulted.
- A2.261 The consultation on Ofcom's proposals for the award of a licence to establish a band manager with obligations to PMSE closed on the 7 September<sup>53</sup> and we are currently carrying out a detailed review of responses to it. Respondents have provided input on licensing issues for the London 2012 Games. Until we have fully considered both sets of responses we believe it inappropriate to reach a definitive view about licensing arrangements for the London 2012 Games. We will publish our conclusions on the licensing arrangements for the London 2012 Games in due course.

**Question 35. Do you agree that an online application process using the LOCOG Rate Card ordering system is the best way for guaranteed users to apply for spectrum licences? How could the licence-application process be made optimal?**

- A2.262 All respondents agreed with Ofcom's proposals to provide on-line application for LOCOG family members using the LOCOG Rate Card system. Respondents identified this as being the most effective way of logging requests and checking the status of individual requests
- A2.263 We were very grateful for some useful feedback from stakeholders on their experience at previous events, and for a number of specific suggestions about the design of the application process which included:
- The importance of applying learning and best practice from previous Games.
  - That the system should ensure that the data entry process is as efficient and simple as possible, particularly as it relates to large or multiple applications.
  - That the on-line application process should be supported by "direct human involvement".
  - That the application process should be supported by good and regular communications, and provide as much certainty over timescales for confirmation of applications as possible. Where possible, the process should provide confirmation of particular assignment as early as possible to support operational planning and equipment procurement.
  - That the process should be piloted at test events.

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<sup>52</sup> <http://www.ofcom.org.uk/consult/condocs/bandmgr/condoc.pdf>

<sup>53</sup> <http://www.ofcom.org.uk/consult/condocs/bandmanager09/>

- That the process should be supported by good communications targeted at the likely users of the system, many of whom may not be familiar with UK or European practice.

## Ofcom's Response

A2.264 Ofcom confirms its intention to receive applications from Olympic Family members through the Internet-based Rate Card ordering system operated by LOCOG, and we will be taking development of this tool forward with LOCOG. Such a system would be based on those at past Games, albeit configured so the information supplied conforms to our requirements for processing requests.

A2.265 In designing the spectrum aspects of the Rate Card system we intend to work with LOCOG to ensure that the user interface, and the licence process as a whole, is as efficient and effective as possible and designed to best meet the needs of stakeholders. In doing this we will apply best practice from previous Games but also to explore ways in which the portal and licensing system can be improved. To help us achieve this we will work with LOCOG to test the portal, and our licensing and spectrum arrangements in general, at test events. More generally we would be happy to consult with stakeholders during the development of the system to ensure the solution is optimal.

A2.266 We would plan to start accepting applications for licences in early 2011. We will encourage their submission as early as possible as spectrum is a finite resource and demand will be high. We would then process applications and, subject to approval, grant licences and provide any additional information necessary to allow equipment to be used.

A2.267 We will make more detail available when we publish our plans on licensing.

## Question 36. How can efficient sharing and coordination between London 2012 Games and non-London 2012 Games spectrum use best be achieved?

A2.268 Respondents recognised the need for ensuring efficient coordination between use of the spectrum by Olympic Family members and other users of the spectrum, they also generally supported Ofcom's stated objective of striking an appropriate balance between ensuring the success of the London 2012 Games and minimising their impact on other spectrum users. Significant messages on this issue were:

- a) the need to minimise the impact of any coordination arrangements on both Olympic and other users of the spectrum. Where it is necessary to intervene Ofcom should pursue dialogue and if possible negotiate access for the Olympics without formal intervention.
- b) details of the need to revoke or vary licences, or introduce new coordination arrangements, should be provided as early as possible.
- c) that the London 2012 Games presented a complex coordination challenge due to its large scale, the number of separate venues, and also the additional challenge of large street based events such as the marathon.
- d) that the arrangements should be clear and provide an unambiguous specification of where particular users are authorised to operate.

- e) a number of respondents proposed that a single manager and coordinator of all spectrum (both Olympic Family members and other stakeholders) would provide a more efficient solution.
- f) a number of respondents highlighted the need for careful planning and cooperation with the new band manager with obligations to PMSE users in order to facilitate efficient sharing and coordination. One respondent provided useful insight into how this might be achieved and stressed the importance of information sharing between those managing the spectrum during London 2012 Games time.
- g) a number of respondents provided useful insight into how effective coordination between Olympic Family members and other users might be achieved; they highlighted that setting aside particular channels for London 2012 Games use only and introducing geographic exclusion zones in particular could place unnecessary restrictions on non-London 2012 Games use if employed arbitrarily.
- h) work together with existing sporting venues to understand requirements and test arrangements.

## Ofcom's response

A2.269 Ofcom re-iterates that some of the spectrum identified in this spectrum plan will be shared with non-London 2012 Games users and that in the run-up to and during the London 2012 Games, it may be necessary to coordinate some of this use with the requirements of the London 2012 Games. In performing this task, Ofcom will seek to strike an appropriate balance between ensuring the success of the London 2012 Games and minimising their impact on other spectrum users. We identified a number of ways in which we might do this which included:

- identifying particular channels that are set aside for London 2012 Games use and not otherwise available for their duration;
- establishing geographic coordination zones where we will perform the necessary technical checks to ensure proper coordination between London 2012 Games and non-London 2012 Games use; and
- establishing geographic exclusion zones around London 2012 Games venues where any spectrum use will require specific additional authorisation from us.

A2.270 In certain circumstances it might be necessary to revoke or temporarily vary licences to allow spectrum use for the London 2012 Games, although we think that such circumstances are likely to be very rare, and we would endeavour to work closely with stakeholders to explore all options to accommodate both London 2012 Games and non-London 2012 Games use prior to taking such action. Such arrangements would vary by band and by service and we would make more details known in due course.

A2.271 We also recognise that effective coordination will be necessary with the band manager with obligations to PMSE users. In our July 2008 consultation<sup>54</sup> on proposals for the award of a licence to establish a band manager with obligations to PMSE users we set out our expectation that the licence to be awarded will restrict

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<sup>54</sup> <http://www.ofcom.org.uk/consult/condocs/bandmngr/condoc.pdf>

the band manager with obligations to PMSE users operations around the Olympic venues during the London 2012 Games period and some associated test events. We expect to set out further details of these arrangements in the Information Memorandum for that award and subsequent co-ordination guidelines. We are currently examining how such arrangement would work in practice but we believe that one key element will be a requirement on licensees to provide high quality information about those authorised by the band manager with obligations to PMSE users to use the spectrum and the terms and conditions on which they are authorised to do so.

### **Question 37. How can the use of licence exempt equipment best be managed?**

A2.272 Certain equipment may be exempted in the UK from the requirement to be licensed under the Wireless Telegraphy Act 2006 because its use is not likely to cause harmful interference. Experience from past Games has shown, however, that the unusual concentration of such equipment in particular venues can create the potential for localised harmful interference. In our consultation document we highlighted that we were exploring with LOCOG how such use can best be managed and asked for views and input on this issue.

A2.273 Respondents agreed that it was sensible to give special consideration to this issue as use was anticipated to be very widespread during the London 2012 Games and might create interference issues for Games-critical uses sharing spectrum with or using technologies which are typically exempt from individual licensing. Respondents provided useful input on how this issue might be addressed including useful insight from previous events; key points raised included:

A2.274 A number of respondents highlighted that it would be difficult to provide the level of coordination and interference management required without special measures being put in place. A number of suggestions and examples of such arrangements from previous events were provided, these were:

- preventing certain types of equipment from being brought into London 2012 Games venues and/or limiting and controlling the deployment of certain exempt technologies;
- actively coordinating use between exempt technologies;
- actively coordinating exempt technologies with licensed services. This is especially relevant to certain technologies that operate in bands that could impact on important London 2012 Games applications such as wireless cameras;
- testing and tagging exempt technologies. This was identified as a way in which Ofcom could ensure that technologies were operating within the permitted technical constraints; and
- creating a register of licence exempt equipment to be maintained through the London 2012 Games so that sources of interference can be identified located and closed down to prevent disruption to licensed users of spectrum.

A2.275 One respondent highlighted the need for Ofcom to take an active role in the resolution of interference to certain exempt technologies where they are important to the success of the London 2012 Games (e.g. LOCOG WLAN applications).

- A2.276 Respondents also highlighted the importance of designing arrangements with a view not only to technologies (and associated frequency bands) which are exempt from licensing in the UK, but also of recognising that exempt technologies are likely to be brought into the country from all over the world.
- A2.277 One respondent suggested that Ofcom should take into account the uncoordinated deployment of high volumes of certain exempt technologies in its planning assumptions.
- A2.278 LOCOG is examining how such use can best be controlled and/or 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.

### **Ofcom's response**

- A2.279 Use of licence exempt technology is particularly widespread in the UK and experience from past Games has shown that the unusual concentration of such equipment in particular venues can create the potential for localised harmful interference. Respondents to the consultation agreed with us that it was sensible to give special consideration to how to coordinate and authorise such technologies.
- A2.280 As Ofcom develops detailed arrangement for spectrum management and licensing for the London 2012 Games we will provide more detail of how such technologies will be managed at Olympic venues. However, whatever arrangements Ofcom may decide to implement these are unlikely to entirely remove the risk of interference from other exempt technologies. For this reason we recommend that, wherever possible, Games-critical applications should avoid using licence exempt bands.

### **Question 38. Do you have any other comments on how best to license spectrum use for the London 2012 Games?**

- A2.281 The BBC reiterated its view that efficient sharing and coordination between London 2012 Games and non-London 2012 Games spectrum use can best be achieved by having the same band manager with obligations to PMSE users and the same application process for both.

### **Ofcom's response**

- A2.282 Ofcom expects to adopt the approach set out under our response to Q36 above.

### **Question 39. How can interference management be most effective in ensuring the successful running of the London 2012 Games? Are there other measures we should consider implementing? To what extent is your response based on previous experience of similar events?**

- A2.283 The BBC said that it believes that the vast majority of interference is not caused deliberately, but rather through non-conformity of equipment with standards and licences. As such, it believes that Ofcom's emphasis needs to be on checking equipment performance – in particular, by having an effective monitoring and enforcement presence on site during the London 2012 Games.

- A2.284 The BBC said that at the Beijing Games equipment was checked for conformity on arrival at sites by well-resourced teams and there was continual monitoring, and that a similar degree of checking will be required at the London 2012 Games. Monitoring will be required in and around the venues including 'outside the fence' and at the cultural events.
- A2.285 The BBC said that the characterisation of RF transmitter equipment, including measurement of operating frequency, modulation bandwidth and spurious radiated components using spectrum analysers may prove quite cumbersome and expensive to implement. This is a particular problem for equipment using active transmit antennas (e.g. some radio microphones and wireless cameras) where the RF PA is integrated into the antenna system preventing access to RF connectors for conducted measurements. In the BBC's view the assessment of antenna performance is particularly difficult and alternative approaches might include external certification by a test house or the equipment manufacturer and the use of bar codes to track equipment deployment. Actual spectrum usage at a particular venue should be monitored with carefully sited antennas feeding spectrum analysers. These can often be networked into LAN systems for remote monitoring; however, it will also be important, the BBC said, to have people 'on the ground'. In practice, it is unlikely to be necessary to have large numbers of people at every venue all of the time: having an unpredictable, highly-visible presence at venues which for example bans camera crews from events for 'bad' behaviour is likely to be a sufficient deterrent to such behaviour.
- A2.286 The BBC also asked that Ofcom consider having an easily accessible interference reporting system, allowing for example interference to be reported via phone, email or text message. This would enable prompt reporting and hence hopefully a quicker resolution of problems encountered.
- A2.287 JFMG said that it believed that Ofcom have captured the most effective methods of interference management within the document and that practical site surveys and measurements in advance of events allow planners to adjust technical assumptions to reflect the real operational environment, therefore maximizing spectrum efficiency and limiting interference potential within the spectrum plan. JFMG said that encouraging early applications also ensures event requirements are known with enough time to tailor the plan and negotiate application amendments with customers and that these processes work together to minimise the risk of interference caused by licensed users within the venue. JFMG said that it used the spectrum planning methods mentioned above as standard for many events. However, in JFMG's view, for major events such as the British Formula 1 Grand Prix, on-site attendance is also necessary as this ensures that any last minute frequency issues can be addressed, that advice on set-up can be given if necessary and proactive monitoring of spectrum usage can be undertaken. Users can then be advised if they are on incorrect frequencies and interference issues can be investigated on the ground. JFMG said that for the London 2012 Games it will be vital to have sufficient staff to deal with these issues as well as equipment approval and checking procedures.
- A2.288 LOCOG strongly recommend that spectrum identified for the London 2012 Games is monitored to get information about its usability and quality, and that licensed radio devices are tested prior to being used in a venue to validate that the correct frequencies have been implemented and remove all illegal users. A tag on approved radio devices will help identify illegal users who enter venues. Spectrum users will often challenge users without the approved tag. LOCOG understand that these practices have reduced the risk of interference at previous Games and other

sporting events such as the Tour de France. The European Radiocommunications Office provides useful guidance for radio usage at special events (report 44 - <http://www.ero-docdb.dk/Docs/doc98/official/pdf/ECCREP044.PDF> ).

A2.289 OBS noted that, as in previous successful Games there should be:

- an efficient and fast testing programme for all transmitting equipment;
- venue-based offices for resolving interference and equipment access problems;
- training to security staff to recognise RF equipment and check stickers; and
- powers to confiscate non-authorised equipment.

A2.290 RAYNET commented that the requirement to operate within the terms of the authorisation should be enforced, especially where controls may be weaker such as with licence exempt devices, and that the scale of the event and the quantity of equipment deployed however to make the deployment of dedicated interference resolution teams a requirement.

A2.291 Another respondent said that interference management at previous London 2012 Games has been slow. Not many RF detection teams were deployed fast enough when problems arose. They said that it is worth educating spectrum users about stickering and equipment checking as most users have no concept of frequency and interference management, that detection teams must have the power to confiscate equipment where agreements are breached and that consequence must be made clear when frequencies are assigned. The RSGB said that well resourced and pro-active monitoring and enforcement arrangements are needed.

A2.292 SiSLive said that it believed that the emphasis needed to be on checking conformity with standards and licence terms, rather than policing, because prevention is better than cure and that there are few deliberate misuses of spectrum - the majority of interference is caused by inadvertent use or 'finger trouble'. SiSLive said that an effective enforcement and monitoring presence on site during the testing and operational days of the London 2012 Games period is vital and that it will serve as a warning to be careful, and will also be able to resolve issues promptly. At the Beijing Games, equipment was checked on arrival at site for conformity by well resourced teams and there was continual monitoring. In London a similar degree of checking will be required, in SiSLive's view, but the monitoring will be even more important as the threat from unlicensed users is probably greater. Having tested and stickered equipment used inside the fence will reduce the amount of interference experienced in London as it has in previous Games. SiSLive would expect there to be regular monitoring of spectrum use in and around the venues including outside the fence operations and at the cultural events. If this monitoring is highly visible it should have a deterrent effect and raise the profile of the issue in the minds of all. A user friendly interference reporting facility will be vital offering contacts via telephone. This would enable prompt reporting of interference whilst it is happening and hopefully lead to a quicker resolution of the problem. However, it will also be important to have people 'on the ground' to investigate and resolve problems.

A2.293 Wembley National Stadium said that it operates an Airspace Management Process to attempt to reduce the potential for interference to radio systems during events. The priority is always to "protect" the safety of life systems operating in and around the stadium whilst at the same time accommodating as much as possible the needs of broadcasters, concert promoters and so on. In their experience Wembley

National Stadium said it is essential to have a combination of process (advance booking of spectrum and notification of licence details to venue owner), on site policing (checking licences, transmitter equipment and locations) and the ability to identify quickly the possible source of interference if it does occur (spectrum monitoring).

## Ofcom's response

A2.294 We expect the London 2012 Games to place unprecedented pressure on the use of spectrum within the capital. Our Field Operations teams will help to ensure the London 2012 Games' success by ensuring key wireless services remain as free from harmful interference as is reasonably practicable and by enforcing spectrum policy. We will use a risk-based approach to determine the appropriate operational response and ensure resources are deployed effectively.

A2.295 As part of our response, we will consider providing a validation service for wireless transmitter equipment that will be used within key London 2012 Games venues. The purpose of this service would be to establish whether equipment settings were consistent with the authorisation to use the equipment. Validation could include measuring operating frequency, transmitter power, modulation bandwidth and spurious emissions. Where appropriate, we will consider working with LOCOG's security staff to ensure only wireless transmitter equipment that has successfully passed these validation checks is taken into London 2012 Games venues.

A2.296 Before the London 2012 Games, we will ensure the spectrum they require is as free from unauthorised use and unwanted emissions as is reasonably practicable. During the London 2012 Games, we will endeavour to resolve any cases of harmful interference to wireless services that arise according to the following operational priorities:

- safety of life
- defence and national security
- business-critical systems
- LOCOG PMR
- OBS
- RHBs
- other members of the Olympic Family
- day-to-day

A2.297 We will consider deploying dedicated interference-resolution teams within key London 2012 Games venues to reduce our response times as far as reasonably practicable.

A2.298 All spectrum users will be required to operate within the terms of their authorisation, including transmitting at the specified frequency. Any found not to be doing so – a criminal offence in the UK – will be required to stop transmitting and to tune to their authorised frequency or apply for one immediately. We may also take enforcement

action – including removing equipment and prosecution – and LOCOG may revoke accreditation.

### **Question 40. Do you have any comments on our approach to test events?**

- A2.299 The BBC said that broadcasters will find test events which most closely approximate real London 2012 Games events to be most useful, and feedback on how the test events went will be vital for learning to be maximised. Given their importance for the smooth running of the London 2012 Games, the BBC asks that spectrum licensing arrangements, and monitoring and enforcement of equipment performance, also be tested during test events.
- A2.300 JFMG said that it will be necessary for those issuing licences for test events to work closely with the band manager with obligations to PMSE users to ensure use is coordinated with day-to-day PMSE operations. JFMG therefore recommend the same approach to these events as highlighted for the London 2012 Games themselves and said that these test events could provide useful opportunities to test information sharing mechanisms with the band manager with obligations to PMSE users and refine the coordinated approach.
- A2.301 LOCOG said that it would like to see spectrum not currently used for broadcasting purposes made available prior to the London 2012 Games to allow sufficient time for users to become familiar with the bands or equipment. LOCOG would also like to see the spectrum plan for test events being the same as for the London 2012 Games especially where there is little or no impact on existing users. LOCOG said that the draft spectrum plan set out in the consultation is mainly for London 2012 Games time and that Ofcom will need to publish the test event spectrum, which LOCOG hopes will be very similar apart from the UHF band IV and V which will be affected by DSO.
- A2.302 OBS said that in some instances OBS may need to perform RF tests outside the typical time window of the test events and that it would expect LOCOG and Ofcom to treat such trials in the same way as those indicated for the test events. SiSLive said that the spectrum needs of test events will be much less than the London 2012 Games themselves, but the London 2012 Games licensing process could be trialled on a test event and that monitoring and enforcement processes could also be trialled.

### **Ofcom's response**

- A2.303 Ofcom will work with LOCOG to ensure that suitable arrangements for testing spectrum availability so far as possible are in place at the relevant test events.

## Annex 3

# Impact Assessment

## London Olympics

- A3.1 On 6 July 2005, London was chosen to host the London 2012 Games. These will take place between 27 July and 9 September 2012 at some 35 competition venues in London and across the UK.
- A3.2 As part of London's bid for the Olympics, the Government gave two binding guarantees to the International Olympic Committee, covering:
- the allocation of the spectrum required for the organisation of the London 2012 Games; and
  - the waiving of fees payable by members of the Olympic Family for the allocated spectrum required for the London 2012 Games.
- A3.3 We are responsible for organising a full spectrum plan for the London 2012 Games and for arranging all the spectrum licences in good time in support of the plan.

## Citizen and consumer interest

- A3.4 We expect that the London 2012 Games will see an increase in spectrum requirements, principally in London, where spectrum is already heavily used. Meeting these requirements, and hence the Government guarantees, is a complex task. We are also concerned to minimise any negative impact on other spectrum users and, ultimately, on citizens and consumers who benefit from those uses. It is for these reasons that we started the task of spectrum planning for the London 2012 Games in 2006, some six years before they begin.
- A3.5 We said in the consultation document that we had not conducted a full impact assessment. This was because we were consulting on a draft spectrum plan to meet the guarantees the Government has given to the IOC on the allocation of the frequencies required for the organisation of the London 2012 Games. Nonetheless, throughout the consultation document, we made qualitative assessments where we had sufficient information to do so.
- A3.6 We remain confident based on our current information that the spectrum plan we presented for consultation will meet the needs of the London 2012 Games without major change, but our approach to the Impact Assessment remains qualitative. We may review our analysis and our conclusions as the plan develops and details of venue-specific requirements become clearer.

## Our objective

- A3.7 As set out in the Statement, Ofcom has a responsibility to organise a full spectrum plan for the London 2012 Games in accordance with the Government's guarantees and to ensure key wireless services are free from harmful interference. This responsibility stems from our legal duties set out in the Communications Act 2003<sup>55</sup>,

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<sup>55</sup> [www.opsi.gov.uk/acts/acts2003/pdf/ukpga\\_20030021\\_en.pdf](http://www.opsi.gov.uk/acts/acts2003/pdf/ukpga_20030021_en.pdf).

which include a requirement to secure the optimal use of spectrum in the interests of citizens and consumers, as well as our duties in the Wireless Telegraphy Act 2006<sup>56</sup>.

## Options

- A3.8 Ofcom must consider the most efficient means of meeting this objective. We believe that, in the context of this impact assessment, the effective “efficient level of demand” is that which meets the guarantees the Government has given to the IOC to ensure the necessary spectrum is allocated. Other, non-guaranteed, demand will be met on the basis set out in the main document and is not addressed in this assessment.
- A3.9 Our ability to quantify the effective “efficient level of demand” will continue to evolve in the run up to the London 2012 Games. In particular we have taken account of responses to the consultation and we are actively seeking access to an additional band for wireless cameras for example.
- A3.10 Because of the scale of the spectrum demand generated by the London 2012 Games, alongside day-to-day requirements that are already high in the capital, we have considered the supply of spectrum from three sources:
- civil spectrum;
  - public sector spectrum holdings; and
  - licence exempt spectrum.
- A3.11 The sources of spectrum identified in the consultation continue to be available and our general approach continues to be to:
- identify efficient demand for spectrum;
  - identify spectrum that can be supplied and how the efficiency of its use might be maximised; and
  - match supply to demand to meet the Government’s spectrum guarantees at least cost to other spectrum users, citizens and consumers.
- A3.12 At this stage of our planning we have focused on London itself as that is where most London 2012 Games venues will be and where spectrum supply is at a particular premium<sup>57</sup>.
- A3.13 Ofcom has considered the opportunity costs of taking or holding back spectrum for the London 2012 Games. At this stage our demand estimates, particularly at a venue-specific level, are not final. We have therefore not considered the long run opportunity costs, which are less relevant to considerations of deferment of spectrum usage rights and will likely have no material impact on the optimal use of spectrum identified in the spectrum plan for the London 2012 Games in the longer term.

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<sup>56</sup> [www.opsi.gov.uk/acts/acts2006/pdf/ukpga\\_20060036\\_en.pdf](http://www.opsi.gov.uk/acts/acts2006/pdf/ukpga_20060036_en.pdf).

<sup>57</sup> We have also assessed the requirements of the five football venues elsewhere in the UK and considered in some detail the needs of the sailing events at Weymouth/Portland.

- A3.14 . We have focused on short run opportunity costs, which are more relevant to questions of deferment of spectrum usage rights, and a qualitative assessment.
- A3.15 Ofcom has set out the spectrum plan so that the demand for spectrum to meet the guarantees will be met from the overall supply in the most efficient (or least cost) way. To do this Ofcom has set out what spectrum bands we will want to use for the following wireless applications:
- PMR services - land and maritime (*inter alia* talkback, telemetry and telecommand)
  - Audio and video links (e.g. wireless microphones and cameras, IEMs and ADS)
  - Other guaranteed services (point-to-point and satellite services, Licence exempt equipment e.g. WiFi and WLANS)
- A3.16 Ofcom's qualitative assessment of short run opportunity costs is based on factors including:
- whether there are civil licences already granted – we differentiate between full licences and those for non-operational purposes;
  - whether the bands are identified by Government for release<sup>58</sup>;
  - where use is for military purposes – defence is treated as a public good, but spectrum, as an input factor of demand for defence, is treated as a private good;
  - where spectrum has some constraint attached to it arising from international treaty or obligation and its use cannot be adjusted except in the long-run; and
  - where short term changes to use in 2012 could have longer term impacts.
- A3.17 Short run opportunity costs in the context of this Impact Assessment refer to the costs of the impact of the London 2012 Games requirements on spectrum demand for the period immediately leading up to and during the London 2012 Games, including where alternative additional spectrum may be required to meet this spectrum demand over this short-run period.
- A3.18 We have assessed the short run opportunity cost as nil, very low or low when public and private use is impacted either not at all or to a very limited extent. We have assessed the short run opportunity cost as medium when either public or private use is impacted to some degree e.g. where some currently available spectrum might be retained for the London 2012 Games, limiting the scope to meet new day-to-day demands around Olympic venues during the London 2012 Games. We have assessed the short run opportunity cost as high when there may be a possibility that Ofcom could vary or revoke Wireless Telegraphy Act licences, significantly limiting scope to meet other demands around Olympic venues during the London 2012 Games.

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<sup>58</sup> [http://www.ofcom.org.uk/consult/condocs/sfrps08/sfrps\\_statement/](http://www.ofcom.org.uk/consult/condocs/sfrps08/sfrps_statement/)

## Private Mobile Radio – Land radio

### Assessment

- A3.19 Based on the experience of the Athens Games, we had forecast demand for 676 channels in the London 2012 Games Olympic Park, 374 in the River Zone and 179 in the Central Zone. Adding 25% to allow for contingency, which we still believe to be a reasonable approach, would see demand for 845 channels in the London 2012 Games Olympic Park, 468 in the River Zone and 224 in the Central Zone.
- A3.20 Spectrum cannot be reused for land radio between the London 2012 Games Olympic Park and the River Zone, but it can be reused between these locations and the Central Zone. Assuming some channels are re-usable, this means we anticipate a need to supply over 1,000 channels. Channel widths for land mobile radio are 12.5 kHz, so the spectrum requirement amounts to 12.5 MHz. However, new demand for E&PSS has emerged since the consultation, which we must also take into account. This new requirement amounts to an additional 1.75 MHz.
- A3.21 Guaranteed users can receive land-radio services in several different ways:
- using LOCOG's network through standard equipment allocation or its Rate Card ordering system;
  - using their own equipment and channels licensed individually to them;
  - using licence-exempt equipment;
  - using a network provided by a third party; and
  - using other means of communication.
- A3.22 In the consultation we identified that there are several disadvantages to our licensing channels individually to guaranteed users with their own equipment:
- it would not use spectrum efficiently. In particular, it would fail to realise the efficiencies achievable from using a trunked network. As a consequence, the amount of spectrum we would need to make available would be relatively high;
  - it is unlikely we could make the same channels available to the same user at all venues. Users may therefore have to change channels as they change locations – the emergency and security services have already identified that this will not be possible in some cases;
  - it would be complicated. In many countries, equipment operates on a fixed 10 MHz duplex split. In the UK, most bands used for land radio are configured for a smaller duplex split such as 6.5, 7 or 8 MHz. Moreover, the configuration for the base- and mobile-transmit frequencies in the UK may also be reversed compared to other countries;
  - there would be a greater impact on the availability of spectrum for day-to-day land radio use.
- A3.23 For all of these reasons, there would be a greater risk of harmful interference between guaranteed uses of the spectrum and between guaranteed users and other uses of the spectrum without a more coordinated approach.

## LOCOG network

- A3.24 LOCOG intends to accommodate users covered by the Government's spectrum guarantees on its land radio network through standard equipment allocation or its Rate Card ordering system. This approach was successfully used at the Beijing Games. It is very spectrally efficient and avoids problems of incompatibility between users' equipment and available spectrum.
- A3.25 LOCOG has contracted with Airwave to provide it with land-radio services. It is expected to meet the needs of the great majority of Olympic Family users with requirements for PMR. The demand for spectrum for the LOCOG network is 2x2.5 MHz duplex and 2 MHz simplex (i.e. 7 MHz). This requirement for spectrum will be met from within the 385-399.9 and 406.1-430 MHz bands.

### Identifying any impacts

- A3.26 Table A2.1 below sets out our qualitative assessment of any impacts arising from use of spectrum from within the 385-399.9 MHz and 406.1-430 MHz bands for guaranteed users.

**Table A2.1 Qualitative assessment of likely short run opportunity costs – E&PSS and the LOCOG network**

<b>Spectrum bands identified to meet wireless applications</b>	<b>Likely use prior to London Olympics (based on evidence from relevant consultations documents)</b>	<b>Likely short run opportunity cost</b>
385-399.9 MHz	This band is exclusively for military use except as agreed by the NFPG. Ofcom concludes that there are no material impacts on existing users as a consequence of releasing spectrum from within the band for the LOCOG network.	Nil/Very low
406.1-410 & 414-420 MHz	These bands are exclusively for military use except as agreed by the NFPG. The MOD shares and coordinates 406.1-410 MHz with passive radio astronomy. There are no other civil users that we are aware of except for a single maritime licence for a 5 watt transmitter at 408 MHz.	Very Low
410-412 & 420-422 MHz	These bands have been allocated for E&PSS to the DoH.	Low/Medium

412-414 & 422-424 MHz	This block has been awarded by auction to Arqiva and has been traded out to Airwave.	Very Low/Low
424-425 & 429-430 MHz	These bands are reserved exclusively for military use except as agreed by the NFPG. Ofcom concludes that there are no material impacts as a consequence of releasing spectrum from within the band for the LOCOG network.	Nil/Very low

### Identifying the impacts on different types of stakeholders

A3.27 **385-399.9 MHz** This band is exclusively for military use except as agreed by the National Frequency Planning Group (NFPG) for non-operational uses. The MOD has said in its strategy that the timing of release of spectrum from within this band is beyond 2012. This means that there will be no deferment of alternative use in the short run.

A3.28 **406.1-430 MHz** This band has been divided into four non-contiguous blocks for the purposes of RSA depending on the primary user.

#### Block A: 406.1-410 MHz, 414-420 MHz, 424-425 MHz and 429-430 MHz – MOD use

A3.29 This block is reserved exclusively for military use except as agreed by the National Frequency Planning Group (NFPG). The MOD shares and coordinates 406.1-410 MHz with passive radio astronomy. There are no other civil users that we are aware of except for a single maritime licence for a 5 watt transmitter at 408 MHz. The band is not currently open to maritime use and no maritime use is recorded by Ofcom.

A3.30 It will be the responsibility of the MOD to ensure coordination with the military radar using 420-450 MHz and located at Fylingdales, including by commercial users to whom spectrum is transferred by trading.

A3.31 The bands in Block A are identified for release within the MOD's Defence Spectrum Strategy, but not until after 2012.

#### Block B: 410-412 MHz paired with 420-422 MHz – E&PSS use

A3.32 Block B has been allocated for E&PSS to the Department of Health (DoH) and DoH has been granted the RSA for this block. There will be a deferment of spectrum usage rights in the short run.

#### Block C: 412-414 MHz paired with 422-424 MHz – awarded to Arqiva

A3.33 This block has been awarded by auction to Arqiva and has been traded out to Airwave. There is no deferment of spectrum usage rights in the short run.

## Block D: 425-429 MHz – shared by mobile radio and PMSE

A3.34 Block D is already shared by numerous business radio and PMSE users that are individually licensed by Ofcom and the Joint Frequency Management Group (JFMG) respectively on a geographically limited basis. There is a complex pattern of sharing in the block with a patchwork of large numbers of individual localised narrowband assignments covering areas tens of kms wide. In the particular circumstances of this block, gains from trading RSA<sup>59</sup> would appear to be limited and disproportionate to the complexity of defining the RSA. Ofcom is not proposing to make RSA available in this frequency band at this time. There is no deferment of alternative use in the short run.

### Choosing the best option

A3.35 The demand for spectrum for the LOCOG network and for E&PSS is constrained by their use of TETRA technology, which is designed to use specific bands. Their spectrum demand is therefore concentrated in the range 380–430 MHz.

A3.36 **385–399.9 MHz** The demand for spectrum in the 385–399.9 MHz band for the LOCOG network will be met from spectrum managed by the MOD and NATO. This band falls under the guarantees and therefore no fee is payable by the users.

A3.37 **406.1-430 MHz** Spectrum for E&PSS network has largely been secured through commercial arrangements e.g. from the Department of Health (DoH) by a time-trade of its RSA rights to Airwave and by time-limited spectrum trades to Airwave. A small demand for up to four 25 kHz channels will be met from spectrum managed by the MOD from within the 406.1-430 MHz band. Although no decision has yet been taken by Government, it is possible that the new off-network requirement for 1.75 MHz for E&PSS will also be sought from within the MOD's spectrum holdings in the 406.1-430 MHz band. This band falls under the guarantees and therefore no fee is payable by the users.

### For those not using the LOCOG network

A3.38 The needs of users covered by the Government's spectrum guarantees that do not make use of the LOCOG network will be met from bands used for PMR, including 137-173 MHz, 430-440 and 450-470 MHz. These bands could also be used for Talkback, although we believe this requirement is better met from capacity in UHF IV and V. We would prefer to see land radio and handheld communications demand being accommodated at 137-173 MHz as this spectrum is much less congested than higher bands, although some equipment will need to use 430-478 MHz.

### Identifying any impacts

A3.39 Table A2.2 below sets out our qualitative assessment of any impacts arising from use of spectrum not set aside for the LOCOG network or for E&PSS for guaranteed users.

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<sup>59</sup> <http://www.ofcom.org.uk/consult/condocs/sfrps08/>

**Table A2.2 Qualitative assessment of likely short run opportunity costs - those not using the LOCOG network**

<b>Spectrum bands identified to meet wireless applications</b>	<b>Likely use prior to London Olympics (based on evidence from relevant consultations documents)</b>	<b>Likely short run opportunity cost</b>
137-173 MHz	Meteorological satellite, Mobile satellite and Radionavigation satellite, Space operations and Research, Maritime mobile (including sonobouys), Land mobile radio, Amateur and Amateur satellite, Radioastronomy, Fixed services	Low/Medium
430-440 MHz	Fixed, Mobile, Radiolocation, Amateur and Amateur satellite  Military	Medium/High
450-470 MHz	Fixed and Mobile services Aviation use (Directorate of Airspace Policy)	Medium
470-478 MHz	Aeronautical Radionavigation, Broadcasting and Mobile	Medium

### **Identifying the impacts on different types of stakeholders**

A3.40 Spectrum in the ranges 137-173 MHz, 450-470 MHz and 470-478 MHz is heavily used and the 450-470 MHz band is congested in London. Any significant use of these bands for the London 2012 Games is likely to impact day-to-day services.

A3.41 At past Games, Amateur radio bands – especially 430-440 MHz – have been used. In the Statement we have noted RAYNET’s response and how this band is used to support St John’s Ambulance, Red Cross and other similar users as well as Amateur Special Event Stations for the cultural events. Using the 430-440 MHz band remains a possibility for the London 2012 Games if demand exceeds our ability to meet it from our preferred bands.

### **Choosing the best option**

A3.42 Ofcom has considered the opportunity costs of taking or holding back spectrum for the London 2012 Games for those PMR land mobile users who do not use the LOCOG network. At this stage our demand estimates, particularly at a venue-specific level, are not final.

- A3.43 If demand cannot be met from the market it may be necessary to revoke or temporarily vary some licences to allow spectrum use for the London 2012 Games. We will work closely with stakeholders to explore all options to accommodate both Games and non-Games use prior to taking such action.

## Private Mobile Radio - Maritime radio

### Assessment

- A3.44 Maritime radio may be used to support the sailing events at Weymouth /Portland. Further meetings of the maritime subgroup<sup>60</sup> of SPGOG will take place in 2009/10 to refine the estimated demand and the arrangements for the sailing events at Weymouth /Portland in the light of test events and Ofcom will develop a venue specific spectrum plan for the sailing events.
- A3.45 There is currently unused capacity within the spectrum used for maritime radio in the Weymouth /Portland area. Ofcom's spectrum plan for maritime use, which may be revised in the light of further information, will make use of some of this unused capacity although this could become scarce between now and the London 2012 Games<sup>61</sup>. Some of this capacity has already been coordinated with France.
- A3.46 The maritime subgroup's forecast was 21 simplex and two duplex coastal-station radio (CSR) international channels and 10 simplex and five duplex CSR (UK) channels. This was based on previous comparable events, including Cowes Week and the Skandia Sail for Gold Regatta and included a full review of existing radiocommunications systems.
- A3.47 Ofcom's spectrum plan for maritime use, which may be revised in the light of further information, includes 35 dual-frequency channels (of which up to 33 can be split into single-frequency channels) and 17 single-frequency channels. This estimate may reduce if LOCOG is able to guarantee performance of the Airwave TETRA network in Weymouth/Portland.

### Identifying any impacts

- A3.48 There is an impact arising from the use of international maritime channels and PMR assignments where these would otherwise be used by the maritime community and for land mobile radio during the period of the London 2012 Games, since there is likely to be an impact on the day-to-day provision of services in this sector. This suggests that some low to medium level of short run opportunity costs will arise from using spectrum in the PMR maritime radio bands.

### Identifying the impacts on different types of stakeholders

- A3.49 We wish to minimise the supply of maritime channels for the London 2012 Games:
- to avoid the need for further coordination with France where possible; and

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<sup>60</sup> Its membership includes equipment manufacturers, British Shipping, Cowes Week Ltd., Dorset Police, LOCOG, 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 Ministry of Defence.

<sup>61</sup> Further information on the expected level of excess demand for maritime and aviation uses can be found at: <http://www.ofcom.org.uk/consult/condocs/aip/>

- to avoid having to impose restrictions on day-to-day use of this spectrum, which may become scarce between now and the London 2012 Games.

A3.50 By dividing some of the available duplex channels into simplex channels, we are able to satisfy the estimated demand. We have already coordinated the temporary use of these channels with France.

### Choosing the best option

A3.51 Ofcom has considered the opportunity costs of taking or holding back spectrum for the London 2012 Olympics for those PMR maritime mobile users who do not use the LOCOG network. At this stage our demand estimates, particularly at a venue-specific level (e.g. for Weymouth/Portland) are not final.

A3.52 Our qualitative assessment indicates that the likely short run opportunity costs are medium except where additional equipment costs may result from splitting duplex channels where we assess the short run opportunity cost to be higher for these channels. The dual-frequency and single-frequency maritime channels that may be made available are given in tables 4 and 5.

## Talkback

### Assessment

A3.53 Talkback is mainly used by broadcasters, allowing producers to give directions to production-team members such as camera operators, reporters and presenters. We understand equipment will not move between venues.

A3.54 Based on the experience of the Athens Games, we had forecast demand for 410 channels in the Olympic Park, 260 in the River Zone and 111 in the Central Zone.

### Identifying any impacts

A3.55 Table A2.3 below sets out our qualitative assessment of any impacts arising from use of spectrum for Talkback for guaranteed users.

**Table A2.3 Qualitative assessment of likely short run opportunity costs - Talkback**

<b>Spectrum bands identified to meet wireless applications</b>	<b>Likely use prior to London Olympics (based on evidence from relevant consultations documents)</b>	<b>Likely short run opportunity cost</b>
430-440 MHz	Fixed, Mobile, Radiolocation, Amateur and Amateur satellite  Military  Any significant use of this band for the London 2012 Games is likely to impact day-to-day services and therefore is likely to have a medium impact on short run opportunity cost.	Medium

450-470 MHz	Fixed and Mobile services Aviation use (Directorate of Airspace Policy)  Spectrum in 450-470 MHz is heavily congested in London. Any significant use of this band for the London 2012 Games is likely to impact day-to-day services including PMR and therefore is likely to have a medium impact on short run opportunity cost.	Medium
470-478 MHz	Aeronautical Radionavigation, Broadcasting and Mobile. Talkback users use duplex channels paired with a non- generic 4 MHz gap within 470-478 MHz. There could be some short run opportunity costs to existing users if Ofcom makes duplex channels available within 470-478 MHz at the London 2012 Games Olympic Park and holds back this spectrum for this purpose	Medium
494-502	Broadcasting	Very Low/Low

### Identifying the impacts on different types of stakeholders

A3.56 **450-470 MHz** Spectrum in 450-470 MHz is heavily congested in London. Any significant use of this band for the London 2012 Games is likely to impact day-to-day services including PMR.

A3.57 **430-440 MHz** At past Games, Amateur radio bands – especially 430-440 MHz – have been used. In the Statement we have noted RAYNET’s response and how this band is used to support St John’s Ambulance, Red Cross and other similar users as well as Amateur Special Event Stations for the cultural events. Using the 430-440 MHz band remains a possibility for the London 2012 Games if demand exceeds our ability to meet it from our preferred bands.

### UHF 1 and 2 (425-470 MHz) and interleaved spectrum (470-550 MHz)

A3.58 The primary PMSE use of this spectrum is Talkback equipment, which is typically deployed by production and broadcasting users. In another consultation document<sup>62</sup> we have suggested that business mobile radio is a potential alternative use of this spectrum.

<sup>62</sup> <http://www.ofcom.org.uk/consult/condocs/bandmanager09/bandmanager09.pdf>

## Choosing the best option

- A3.59 Talkback users in the UK already use duplex channels paired with a non-generic 4 MHz gap within 470-478 MHz. To minimise the impact on existing users, we may also make duplex channels available within 470-478 MHz in the Olympic Park, within 494-502 MHz in the Central Zone and within both bands in the River Zone.

## Telemetry and telecommand

### Assessment

- A3.60 Telemetry and telecommand will be used at the London 2012 Games to control cameras, camera shutters and other equipment remotely and for localised data communications.
- A3.61 The use of telemetry and telecommand is increasing over time. Based on our understanding of past Games, we have forecast demand for critical services for 50 channels in the Olympic Park, 20 channels in the River and Central Zones, 10 channels in Weymouth /Portland and 20 channels distributed across other venues. This is greater than at the Athens Games.

### Identifying any impacts

- A3.62 Spectrum is available for telemetry and telecommand on a licence exempt basis. There are no competitive impacts identified.
- A3.63 The short run opportunity cost impact arising from the use of licence exempt spectrum for international maritime channels and national PMR assignments is qualitatively assessed by Ofcom as being very low during the period of the London 2012 Games.

### Identifying the impacts on different types of stakeholders

- A3.64 Ofcom notes that in some cases PMR devices could be used to carry data and that this may often be the case for telemetry applications, which do not use licence exempt spectrum. We will make spectrum available for telemetry and telecommand on an exclusive basis within the Olympic Park as part of our venue-specific spectrum plan in the light of more details of the demand from users.

### Choosing the best option

- A3.65 Ofcom notes that in some cases PMR devices could be used to carry data and that this may often be the case for telemetry applications, which do not use licence exempt spectrum. We may make spectrum available for telemetry and telecommand on an exclusive basis within the Olympic Park as part of our venue-specific spectrum plan in the light of more details of the demand from users.
- A3.66 Ofcom will consider whether there is a requirement to use the primary and secondary allocations to the Amateur and Amateur-Satellite Service as it develops its venue specific spectrum plans. We will continue to work closely with key stakeholders as we develop these plans.

## Wireless microphones and IEMs

### Assessment

- A3.67 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. As we said in the consultation, even modest improvements in the efficiency with which this spectrum is used compared to normal practice (e.g. as achieved during the London stages of the 2007 Tour de France) would ensure the peak demand of the Opening and Closing Ceremonies could be met with the spectrum that will be available.
- A3.68 The biggest requirement for wireless microphones and IEMs at past Games has come from the Opening and Closing Ceremonies. This will, to some extent, be within LOCOG's control. We understand there will be limited demand from Rights Holding Broadcasters (RHBs) during these events.
- A3.69 Based on the Athens and Beijing Games, we believe we will need to accommodate a peak in the Olympic Stadium during the Opening Ceremony of the London Olympic Games of:
- up to 350 wireless microphones; and
  - up to 100 IEMs.

### Identifying any impacts

- A3.70 Table A2.4 below sets out our qualitative assessment of any impacts arising from use of spectrum for Wireless microphones and IEMs for guaranteed users.

**Table A2.4 Qualitative assessment of likely short run opportunity costs - Wireless microphones and IEMs**

Spectrum bands identified to meet wireless applications	Likely use prior to London Olympics (based on evidence from relevant consultations documents)	Likely short run opportunity cost
Digital dividend (600 MHz, 800 MHz and interleaved spectrum – wireless microphones and IEMs)	Ofcom anticipates that the award of the 800 MHz band for new uses could take place in late 2010 and that the award of the 600 MHz band for new uses could take place in late 2010 or 2011. The rollout of new networks in those bands would begin sometime thereafter, during 2011/12, while the bands themselves will not be available UK-wide until the end of DSO in late 2012. Our assessment of the opportunity cost of interleaved spectrum <sup>[1]</sup> has	Low

<sup>[1]</sup> <http://www.ofcom.org.uk/consult/condocs/bandmanager09/bandmanager09.pdf>

	<p>led us to consider that, at present, there is limited evidence of commercially and technically viable uses other than PMSE. We will assess the impact of Games use on PMSE in the coordination guidelines we expect to publish in due course.</p>	
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## Identifying the impacts on different types of stakeholders

- A3.71 London will switch over from analogue to DTT in April 2012. From that point, the availability of channels in UHF Bands IV and V for wireless microphones and IEMs in the Olympic Park is expected to be as set out in table 6 of the Statement.
- A3.72 In addition, Channel 70, which is used for licence exempt equipment, will be available. Ofcom is aware that a large number (approximately 1500 according to information provided by MLEC UK Ltd) of wireless microphones are used on the underground system throughout London for making station and platform announcements across the entire London underground system. These wireless microphones operate within channel 70, also on a licence exempt basis.

## Choosing the best option

- A3.73 Some 39 channels (each of 8 MHz, totalling up to 312 MHz) will be available from spectrum that will comprise the UK's digital dividend after DSO<sup>63</sup>. Spectrum availability may be less at other London venues (e.g. the ExCeL Exhibition Centre and Greenwich) because of greater use by DTT, but the forecast requirement for wireless microphones and IEMs is significantly lower than at the Olympic Park.

## Wireless cameras

### Assessment

- A3.74 In our consultation we suggested that there would be a high level of demand for spectrum for wireless cameras at the London 2012 Games. The spectrum plan identified capacity that could be made available by obtaining access to spectrum from UK public sector bodies – notably the Ministry of Defence and the Civil Aviation Authority– and these bodies have committed to make some of the spectrum they manage available for temporary use for the London 2012 Games subject to necessary arrangements to ensure that essential defence and safety of life services are protected. Ofcom is also working with the Maritime and Coastguard Agency to make available capacity in spectrum used for maritime services.

### Identifying any impacts

- A3.75 Table A2.5 below sets out our qualitative assessment of any impacts on arising from use of spectrum for wireless cameras and IEMs for guaranteed users.

<sup>63</sup> [www.ofcom.org.uk/consult/condocs/800mhz/800mhz.pdf](http://www.ofcom.org.uk/consult/condocs/800mhz/800mhz.pdf).

**Table A2.5 Qualitative assessment of likely short run opportunity costs - Wireless cameras and IEMs**

<b>Spectrum bands identified to meet wireless applications</b>	<b>Likely use prior to London Olympics (based on evidence from relevant consultations documents)</b>	<b>Likely short run opportunity cost</b>
3400-3600 MHz	<p>Band is currently used for wireless cameras and MOD has said that the band will be available until such time as its policy develops once the RSA rights have been granted<sup>64</sup>.</p> <p>This excludes the 2x20 MHz already assigned by auction in 2003 and the 33 MHz that is used for heli telly operations.</p> <p>The band is already subject to European-wide harmonisation for broadband wireless services.</p> <p>MOD has said it will commence the release of spectrum from within this band by November 2010.</p> <p>We expect that deferring spectrum rights in this band around some of the London 2012 Games venues would represent a low to medium short run opportunity cost, based on the likely delay to the award of RSAs for these locations in the and the use of this band for broadband wireless-type services and information regarding military use of the band. The level of short run opportunity cost will depend on the extent that services can be rolled out. The MOD has not yet taken a decision to release this band.</p>	Low/Medium
3100-3400 MHz	<p>There are no civil applications at present within this band and MOD has no plans to release this band to the market before 2012/13.</p> <p>The band is managed by NATO and spectrum sharing with wireless cameras, particularly with</p>	Very Low

<sup>64</sup> [http://www.ofcom.org.uk/consult/condocs/3\\_4ghz/](http://www.ofcom.org.uk/consult/condocs/3_4ghz/)

	the current airborne military use would be complex	
2700-3100 MHz	<p>This band is jointly use for civil and military radars (maritime, land and aeronautical). The band is planned and managed by the CAA, MCA, MOD and the Met Office.</p> <p>Sharing spectrum between civil aeronautical radars and wireless cameras is feasible, but complex.</p> <p>The CAA has published details of sharing constraints at Olympic venues. The MCA does not think that constraints on civil maritime uses will be feasible.</p>	Medium/High

### Identifying the impacts on different types of stakeholders

A3.76 The preference of most respondents is for capacity between 2000 MHz and 4000 MHz, but to meet the highest level of likely demand Ofcom will make spectrum at 7000 MHz, 10 GHz and above available for wireless cameras if required. Ofcom believes that the demand for spectrum for wireless cameras at frequencies commonly used by broadcasters and for which equipment is readily available (i.e. 2000 MHz to 4000 MHz, and 7000 MHz) can be met.

A3.77 The 3400-3600 MHz<sup>65</sup> band was not included in the consultation because it forms part of the MOD's Defence Spectrum Strategy<sup>66</sup> and is scheduled for release by the MOD before 2012. We now believe that it very important that some capacity in this band is made available for wireless cameras for the London 2012 Games.

### Choosing the best option

A3.78 We believe we will need to accommodate a peak of up to 75 wireless-camera channels in simultaneous use. This is based on:

- a peak of 36 channels experienced at the Beijing Games;
- the scope to reuse spectrum between the Olympic Park, the River Zone, the Central Zone and Eton Dorney; and
- a generous allowance for growth given how production values (e.g. point-of-view cameras, high definition services) have taken advantage of developments in technology.

<sup>65</sup> See Ofcom's consultation: [http://www.ofcom.org.uk/consult/condocs/3\\_4ghz/](http://www.ofcom.org.uk/consult/condocs/3_4ghz/)

<sup>66</sup> [http://www.mod.uk/NR/rdonlyres/40622FC9-DC7B-40FC-B48A-90408F6F7676/0/spectrumstatement\\_051208.pdf](http://www.mod.uk/NR/rdonlyres/40622FC9-DC7B-40FC-B48A-90408F6F7676/0/spectrumstatement_051208.pdf)

A3.79 In our consultation document, we had made no allowance for any reductions in demand – perhaps up to 15 channels in simultaneous use – that could be achieved by deploying a London-wide cellular receive system.

A3.80 Although Ofcom is encouraging users to adopt best practice when siting wireless cameras, we will continue to plan on the basis that using adjacent channels is not possible without causing harmful interference, leading to a maximum peak requirement for 149 channels if they are all contiguous.

A3.81 We anticipate airborne use of some channels to allow wireless camera coverage of wide-area events (e.g. the marathons and the sailing events). Based on the experience of the Beijing Games, we had forecast demand for three airborne wireless channels in simultaneous (co-coverage) use, but a better estimate of demand is likely to emerge later this year when the results of the survey of aviation sector's requirements is completed by the Department for Transport's Aviation Stakeholder Group. Additional spectrum for airborne wireless cameras may be available if spectrum from within the 3400–3600 MHz band becomes available. Until then we will limit the number of channels available for airborne use to:

- meet international coordination requirements; and
- comply with the conditions under which some spectrum can be made available.

A3.82 Several considerations underpin our proposals for wireless cameras:

- we still expect OBS and RHBs to use wired rather than wireless cameras wherever practicable because of the greater quality and reliability they afford;
- we have identified more spectrum than the forecast demand requires to give users the opportunity to indicate which bands they would prefer to use and which they would be willing to use if they cannot use their preferred bands (particularly because of excess demand). We will have to prioritise the order in which we assign bands because of the complexity of managing spectrum in some of the venues, e.g. airborne wireless cameras used to cover the sailing event would need to be assigned outside civil maritime radar bands;
- not all channels within available bands will offer comparable utility, but their use in certain circumstances should not be discounted at this stage of spectrum planning for the London 2012 Games;
- even within preferred bands, we understand new clip-on transmitters can allow wireless cameras to tune over as much as 500 MHz from a user-selected frequency that can be factory-set to anything between 1300 MHz and 7500 MHz; and
- spectrum in the 1300 MHz and 4800 MHz range will be made available for airborne cameras. Below this range, it is difficult to secure sufficient bandwidth and equipment is not readily available. Above this range, signal alignment and propagation characteristics are not favourable.

### Identifying any impacts

A3.83 Table A2.5 below sets out our qualitative assessment of any impacts on arising from use of spectrum for airborne Wireless cameras for guaranteed users.

**Table A2.5 Qualitative assessment of likely short run opportunity costs – airborne Wireless cameras**

<b>Spectrum bands identified to meet wireless applications</b>	<b>Likely use prior to London Olympics (based on evidence from relevant consultations documents)</b>	<b>Likely short run opportunity cost</b>
2025-2110 MHz	<p>Fixed and Mobile services. PMSE Airborne use is currently allowed.</p> <p>Any significant use of this band for the London 2012 Games is likely to impact day-to-day services and therefore is likely to have a medium/high impact on short run opportunity cost.</p>	Medium/High
3400-3600 MHz	<p>Band is currently used for wireless cameras and MOD has said that the band will be available until such time as it policy develops once the RSA rights have been granted.</p> <p>This excludes the 2x20 MHz already assigned by auction in 2003 and the 33 MHz that is used for heli telly operations.</p> <p>The band is already subject to European-wide harmonisation for broadband wireless services.</p> <p>MOD has said it will commence the release of spectrum from within this band by November 2010.</p>	Low/Medium
5682.5-5702.5 MHz	<p>Mobile, Radiolocation, Amateur and Amateur satellite Space research PMSE</p> <p>Any significant use of this band for the London 2012 Games is likely to impact day-to-day services including PMR and therefore is likely to have a low/medium impact on short run opportunity cost.</p>	Low/Medium

7110-7250 MHz	<p>Fixed and Mobile services, Space research and PMSE</p> <p>Any significant use of this band for the London 2012 Games is likely to impact day-to-day services including PMR and therefore is likely to have a low/medium impact on short run opportunity cost.</p>	Low/Medium
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### Identifying the impacts on different types of stakeholders

**A3.84** In the light of these considerations, we propose to make the bands set out in table 9 of this Statement available for wireless cameras. Also indicated is the number of 10 MHz channels in each band we currently think might be available in the Olympic Park during the London 2012 Games. These estimates are likely to change at the margin as we receive new information.

### Choosing the best option

- A3.85** At this stage, we believe 137 channels, which will fulfil almost our entire conservative forecast, could potentially be sourced between 1300 MHz and 4800 MHz. These are all frequencies that broadcasters are accustomed to using and/or for which we understand equipment is already readily available.
- A3.86** Based on the current expectations, these channels would also suffice for airborne use. To accommodate multiple simultaneous wide-area events we will try to clear more channels for airborne use, particularly in the range 3100 to 3600 MHz.
- A3.87** We do not believe it necessary to rely on spectrum at 2400 MHz and 5000 MHz available for licence-exempt use by WiFi and WLANs, though it could be used if desired nor do we believe it necessary to rely on EHF spectrum in the range 5000 MHz to 10 GHz, though it could be used if desired. We also do not believe it necessary to rely on SHF spectrum, though this too could be used if desired.
- A3.88** If it proves necessary to make 20 MHz channels available we will create these from two adjacent 10 MHz channels (although the band 3400-3600 is already channelized in 20 MHz blocks), but doing so could significantly reduce the number of wireless cameras that could use high-demand bands.

### Audio Distribution Services

- A3.89** Audio distribution services (ADS) retransmit material already prepared for public use. They cover events and other temporary purposes.
- A3.90** 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. We will plan the frequencies required in the light of LOCOG and the ODA's definition of their requirement for Live ADS, including that needed for the cultural events.

## Identifying any impacts

- A3.91 Spectrum is available for ADS within licence exempt bands. We have not identified any impacts arising from the use of spectrum for the London 2012 Olympics for guaranteed users at this stage.

## Identifying the impacts on different types of stakeholders

- A3.92 The current allocation identified for ADS is limited to only 4 channels (channels at 61.2, 61.7, 62.3 and 62.7 MHz) with a 1W output maximum.

## Choosing the best option

- A3.93 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, subject to coordination with the MOD.

## Point-to-point links

### Assessment

- A3.94 There will be a requirement for point-to-point links for the London 2012 Games, for example to provide backhaul for the LOCOG network. Some could carry video streams to the IBC, a production truck or a satellite uplink, as seen during the London stages of the 2007 Tour de France. Others could be required to support the sailing events at Weymouth Bay/Portland Harbour. And they have a role to play where it is impractical or prohibitively expensive to deploy fibre.
- A3.95 A specific forecast would not be helpful for spectrum-planning purposes this far ahead of the London 2012 Games, not least because of the variation in required bandwidth and the scope for frequency reuse as a result of using highly directional antennas.

## Identifying any impacts

- A3.96 The frequency bands and assignment arrangements are those already in current day-to-day use. We have not identified any impacts arising from the use of spectrum for the London 2012 Games for guaranteed users at this stage.

## Identifying the impacts on different types of stakeholders

- A3.97 Where terrestrial point-to-point links can be planned in advance, we expect the spectrum requirements they generate to be met using bands available for fixed links on a day-to-day basis.
- A3.98 It may be more suitable for terrestrial point-to-point links deployed at short notice to use spectrum specifically proposed for wireless-camera use to reduce the need for coordination with other users. (In bands available for fixed links on a day-to-day basis, normal coordination procedures would apply.) If so, our preference would be to look first at the range 5000 MHz to 10 GHz where we believe congestion is much less likely.

## Choosing the best option

A3.99 The bands we have identified for point-to-point links are set out in table 10 of the Statement. Where bands are managed by MOD, their availability is subject to coordination. It seems unlikely that we can anticipate much reduction in demand for point-to-point links by using alternative solutions (e.g. free-space optics).

## Other guaranteed services

### Fixed Satellite services, Mobile satellite services and Radionavigation satellite services

#### Assessment

A3.100 We expect there may be demand for a limited number of short-term licences for Permanent Earth Stations (PES) at some venues, including the IBC and Weymouth Bay/Portland Harbour.

A3.101 As PES are planned well in advance and at a known fixed location, we expect the spectrum requirements they generate to be met on a business-as-usual basis. The bands for PES use are shown in table 11 of the Statement.

A3.102 TES are transportable in nature but transmit from a fixed known location at any one point in time. The bands for TES use are shown in table 12 of the Statement.

A3.103 Mobile satellite services (MSS) operate globally through a number of geostationary and non-geostationary satellite constellations, with service links operating in internationally coordinated bands within the range 1000 MHz to 3000 MHz. They support general consumer voice communications and broadband video/data transmissions. In addition, they provide communication links for defence and security services that are independent of terrestrial networks<sup>67</sup>.

A3.104 Radionavigation satellite services (RNSS) – commonly known as “sat nav” – 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 of people, goods and terminals and for timing and synchronisation.

#### Identifying any impacts

A3.105 The frequency bands and assignment arrangements all these services are already in current day-to-day use. We have not identified any impacts arising from the use of spectrum for the London 2012 Games for guaranteed users at this stage.

#### Identifying the impacts on different types of stakeholders

A3.106 MSS terminals are likely to be used during the London 2012 Games at venues. Some will be used specifically for operational tasks associated with the Games.

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[www.cabinetoffice.gov.uk/ukresilience/preparedness/resilient\\_telecommunications/enhancing/catalogue.aspx](http://www.cabinetoffice.gov.uk/ukresilience/preparedness/resilient_telecommunications/enhancing/catalogue.aspx).

- A3.107 We do not foresee any impact on different stakeholders as we are not providing additional access or spectrum for PES or TES as fixed satellite spectrum is coordinated internationally and access is mainly via commercial agreements with satellite operators based on the capacity on each satellite network.
- A3.108 MSS terminals are likely to be used during the London 2012 Games at venues. Some will be used specifically for operational tasks associated with the Games.
- A3.109 RNSS will be widely used at the London 2012 Games at all venues. RNSS receivers are licence-exempt. The available bands are set out in table 14 of the Statement.

### **Assessing the impacts and choosing the best option**

- A3.110 We do not foresee the need for further spectrum for PES, TES, MSS or RNSS as spectrum for it is coordinated internationally and access is mainly via commercial agreements with satellite operators based on the capacity of each satellite network.

### **Licence exempt services**

- A3.111 Wireless Local Area Networks (WLANs) are also known as Wi-Fi and hot spots.
- A3.112 WLANs will be provided by LOCOG for the press and media, although it and its partners will be designing venues to maximise wired connectivity.
- A3.113 Certain equipment may be exempted in the UK from the requirement to be licensed under the Wireless Telegraphy Act because its use is not likely to cause harmful interference. Experience from past Games has shown, however, that the unusual concentration of such equipment in particular venues can create the potential for localised harmful interference.
- A3.114 During the Vancouver Games, VANOC will be providing both wired and, in certain high-traffic locations such as the Olympic and Paralympic Villages, the MPC and the Media Centre, WLAN Internet services. Within Olympic Net Zone wireless hotspots, use of personal WLAN routers will not be permitted. Use of WLAN routers will be permitted in designated locations outside these Zones. Anyone bringing in their own WLAN services will have to use the 5000 MHz band and the 802.11a networking standard. They will not be able to use the 2400 MHz band (802.11 b/g/n) or selected channels at 5000 MHz (802.11 a/n). VANOC will stipulate the SIDH and channel assignment.

### **Identifying any impacts**

- A3.115 Likely users could be impacted either by interference or prohibition on use. Ofcom has not carried out an analysis of the options at this stage.

### **Identifying the impacts on different types of stakeholders**

- A3.116 LOCOG has not yet made any similar decisions to those of VANOC about the London 2012 Games, but controlling use of the 2400 MHz and 5000 MHz bands could help to reduce congestion for WLANs and harmful interference to other services.

## Assessing the impacts and choosing the best option

A3.117 Table 16 sets out the available bands, maximum power levels and applicable UK Interface Requirements (IRs).

## Conclusion

A3.118 We broadly conclude that we expect there to be no net negative impact on citizens or consumers from our plan. The impacts on existing users are likely to be very limited and justified by the very substantial consumer benefits<sup>68</sup>, which the London 2012 Games will bring, not least to the estimated 5 billion television audience. We do not anticipate revoking or varying existing licences to meet the requirements of the London 2012 Games although if our assessments of demand and supply change, we may be required to do so. We do anticipate having to impose some restrictions on day-to-day spectrum use for PMSE at times and in locations of peak London 2012 Games demand. We will, of course, endeavour to keep these restrictions to the minimum necessary.

A3.119 We may review our analysis and our conclusions as the plan develops and details of venue-specific requirements become clearer.

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<sup>68</sup> <http://www.london.gov.uk/mayor/olympics/index.jsp>

## Annex 4

# Equality Impact Assessment

A4.1 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. Three potential impacts on equality have been identified in relation to this Statement and we discuss them 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

A4.2 The RNIB raised the question of spectrum provision for Live and Broadcast Audio Description Services (referred to in this Statement as Audio Distribution Services – ADS), and the testing of these services, in their consultation response. In particular they commented that:

- our proposed approach was based on previous large scale events where audio description was not provided for blind and partially sighted people. These events are not representative of what needs to be provided for the London 2012 Games; and
- they wanted to ensure that spectrum was available for audio description at all the venues, not just the main Olympic Park venues, and during cultural events.

A4.3 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. Ofcom will make spectrum available for ADS for blind and partially sighted paralympian athletes attending the Opening and Closing Ceremonies so that they can access the live audio description commentary if LOCOG decide to implement this service. In order to plan for this we need LOCOG and the ODA to define their precise requirement for Live ADS, including that needed for the cultural events.

A4.4 In relation to Broadcast ADS the broadcasters already have sufficient spectrum for the provision of television audio description.

A4.5 Our test plan includes an opportunity to test both Live and Broadcast ADS.

## Day-to-day spectrum use

A4.6 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**

A4.7 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. To date, we have not yet been approached by anyone with concrete proposals to operate London 2012 Games-related FM RSL services; however, it remains possible that one or more such proposal will be forthcoming. We would need to consider carefully the impact on potential Ramadan RSL operators should any such application be received. We are currently planning to invite preliminary expressions of interest in short-term London 2012 Games-related broadcast radio services early in 2010.

## Annex 5

# Glossary of Abbreviations

<b>ADS</b>	Audio distribution services
<b>AIP</b>	Administered incentive pricing
<b>BEIRG</b>	British Entertainment Industry Radio Group
<b>BIS</b>	Department for Business, Innovation and Skills
<b>CAA</b>	Civil Aviation Authority
<b>CSR</b>	Coastal-station radio
<b>CTCSS</b>	Continuous Tone-Controlled Signalling System
<b>DCS</b>	Digitally Coded Squelch
<b>DFS</b>	Dynamic frequency selection
<b>DSO</b>	Digital switchover
<b>DTT</b>	Digital terrestrial television
<b>E&amp;PSS</b>	Emergency and public-safety services
<b>EHF</b>	Extremely High Frequency
<b>EIRP</b>	Effective isotropically radiated power
<b>FIFA</b>	Fédération Internationale de Football Association
<b>FSS</b>	Fixed satellite service
<b>GHz</b>	Gigahertz
<b>GPS</b>	Global Positioning System
<b>HD</b>	High definition
<b>IBC</b>	International Broadcast Centre
<b>IEM</b>	In-ear monitor
<b>IOC</b>	International Olympic Committee
<b>IR</b>	Interface Requirement
<b>kHz</b>	Kilohertz
<b>LOCOG</b>	London Organising Committee of the Olympic Games and Paralympic Games

<b>MCA</b>	Maritime and Coastguard Agency
<b>MHz</b>	Megahertz
<b>MNO</b>	Mobile-network operator
<b>MOD</b>	Ministry of Defence
<b>MoU</b>	Memorandum of Understanding
<b>MPC</b>	Main Press Centre
<b>MSS</b>	Mobile satellite services
<b>mW</b>	Milliwatt
<b>NOC</b>	National Olympic committee
<b>OB</b>	Outside broadcast
<b>OBS</b>	Olympic Broadcasting Services
<b>ODA</b>	Olympic Delivery Authority
<b>PES</b>	Permanent earth station
<b>PMR</b>	Private mobile radio
<b>PMSE</b>	Programme-making and special events
<b>PSSPG</b>	Public Safety Spectrum Policy Group
<b>RHB</b>	Rights-holding broadcaster
<b>RNSS</b>	Radionavigation satellite services
<b>SHF</b>	Super High Frequency
<b>SIDH</b>	System Identification for Home System
<b>SPGOG</b>	Spectrum Planning Group for the Olympic Games and Paralympic Games
<b>SRD</b>	Short-range device
<b>S-RSL</b>	Short-term restricted-service licence
<b>TES</b>	Transportable earth station
<b>TETRA</b>	Terrestrial Trunked Radio
<b>TPC</b>	Transmitter power control
<b>UHF</b>	Ultra High Frequency
<b>UKSSC</b>	Cabinet Official Committee on UK Spectrum Strategy

<b>UEFA</b>	Union of European Football Associations
<b>VANOC</b>	Vancouver Organising Committee for the 2010 Olympic and Paralympic Winter Games
<b>W</b>	Watt
<b>WCATV</b>	Wireless CATV
<b>WLAN</b>	Wireless local-area network