



London 2012 Olympic Games  
and Paralympic Games  
Draft spectrum plan

Consultation

Publication date: 27 May 2009

Closing date for responses: 5 August 2009



# Contents

Section		Page
1	Executive summary	1
2	Introduction	6
3	Approach	14
4	Assumptions and summary conclusions	24
5	Private mobile radio	32
6	Audio links	37
7	Video links	40
8	Other guaranteed services	45
9	Football venues	51
10	Cultural events	52
11	Non-guaranteed services	55
12	Innovation and legacy	58
13	Operational issues	59
14	Test events	62
15	Next steps	64
<b>Annex</b>		<b>Page</b>
1	Responding to this consultation	65
2	Our consultation principles	67
3	Consultation-response cover sheet	68
4	Consultation questions	70
5	Venues for the London Games	73
6	SPGOG terms of reference and membership	75
7	Glossary of abbreviations	77

## Section 1

# Executive summary

1.1 Ofcom is the independent regulator and competition authority for the UK communications industries, with responsibilities across television, radio, telecommunications and wireless communications services. This document sets out our proposals for making spectrum available for wireless communications, including high-level approaches to licensing/authorisation and interference management, at the London 2012 Olympic Games and Paralympic Games.

## Spectrum planning for the London Games

1.2 The London Games will take place between 27 July and 9 September 2012. They will be staged at various locations around the UK, concentrating on the new Olympic Park to be built in the Lower Lea Valley. Wireless services will play an important role both in the build-up to and during the Games.

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

1.4 At the same time, we recognise the importance of services not covered by the Government's spectrum guarantees to the success of the London Games. We are working to ensure that any spectrum requirements they generate because of the unique nature of the Games are met and coordinated with other uses.

1.5 In all this, it must be recognised that spectrum is a scarce resource in very short supply – nowhere more so than in London.

## Approach

1.6 Our general approach has been to:

- identify demand for spectrum and how it might be reduced;
- 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.

1.7 We have focused on London itself as that is where most Games venues will be and where spectrum supply is at a particular premium. We have also assessed the requirements of the five football venues elsewhere in the UK and considered in detail the needs of the sailing events at Weymouth Bay and Portland Harbour.

## Demand and supply

1.8 We expect the London Games to give rise to spectrum requirements unprecedented in their scale and complexity for a single event. Our objective is to meet the Government's spectrum guarantees, in respect of members of the Olympic Family. But there will also be high demand from non-rights-holding broadcasters, related activities such as cultural events and other services not covered by the Government's spectrum guarantees that are important to the success of the Games.

1.9 In assessing demand for spectrum for the London Games, we have:

- examined the requirements for past Games and comparable events;
- considered responses to a discussion document we published on 30 November 2007 on our approach to spectrum planning for the Games;<sup>1</sup>
- explored options for minimising the spectrum requirements for private mobile radio (PMR), notably those for the London Organising Committee of the Olympic Games and Paralympic Games (LOCOG), which will provide services to other members of the Olympic Family through its own service provider;
- commissioned consultants to report on the scope for greater use of wired technology; and
- taken into account existing availability of equipment on the market.

1.10 In assessing the supply of spectrum for the London Games, we have:

- used information about the availability of public-sector spectrum holdings;
- analysed how spectrum is used abroad whence we believe equipment will be brought into the UK;
- explored options for more efficient use by wireless microphones and wireless cameras; and
- taken into account the Government's plans for introducing a market-based approach to public-sector spectrum management. These plans, published most recently in its Forward Look 2009,<sup>2</sup> are particularly important to departments with spectrum-release plans or targets.

## Draft plan

1.11 This consultation document sets out a draft spectrum plan to meet the Government's spectrum guarantees with minimum disruption to other users. We have sought first to make use of unencumbered spectrum, then spectrum that will require specific measures to facilitate shared access with existing users and only in the last resort to temporarily remove existing users from spectrum for the duration of the London Games requirement.

1.12 At present, we do not anticipate revoking or varying existing spectrum licences to meet the requirements of the London Games. Should our assessments of demand

---

<sup>1</sup> [www.ofcom.org.uk/consult/condocs/spectrum2012/condoc.pdf](http://www.ofcom.org.uk/consult/condocs/spectrum2012/condoc.pdf).

<sup>2</sup> [www.berr.gov.uk/files/file46420.pdf](http://www.berr.gov.uk/files/file46420.pdf).

and supply for spectrum change, we may be required to do so. We do anticipate having to impose some restrictions on business-as-usual spectrum use for programme-making and special events (PMSE) at times and in locations of peak Games demand. We will, of course, endeavour to keep these to the minimum necessary.

- 1.13 We anticipate some of the demand will be met from spectrum managed by UK public-sector bodies. We expect that spectrum to be returned to those bodies after the Games requirement has passed.

### PMR

- 1.14 LOCOG intends to provide services to members of the Olympic Family through a contract with Airwave using spectrum secured through existing allocation and assignment processes. If this opportunity is taken up by organisations that would normally provide their own PMR handsets, we will need to cater for only a limited number of relatively small users who insist on their own systems and for PMR-type talkback systems.

### Wireless microphones

- 1.15 Most wireless microphones will only operate in UHF Bands IV and V, sharing with analogue and digital terrestrial television (DTT). We believe 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.

### Wireless cameras

- 1.16 UK public-sector bodies – notably the Ministry of Defence (MOD), the Civil Aviation Authority (CAA) and the Maritime and Coastguard Agency (MCA) – have committed to allowing use of some of the spectrum they manage for temporary use for the London Games subject to necessary coordination arrangements. This means we should be able to satisfy demand for wireless cameras at frequencies commonly used by broadcasters and/or for which equipment is readily available. 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 to encourage this.

### **Next steps**

- 1.17 We welcome all views from stakeholders on the questions raised in this consultation document. Responses are due by 5 August 2009.
- 1.18 We recognise many stakeholders involved in the London Games may not be familiar with our consultation processes, Ofcom itself or the regulatory environment for wireless services in the UK. We will be happy to discuss our proposals in detail during the consultation period with stakeholders who would find this helpful.
- 1.19 We intend to publish a statement on the spectrum plan for the London Games by the end of 2009. We anticipate it will be subject to ongoing refinement in the run-up to the Games themselves. It is therefore important to note that the spectrum plan and broader spectrum policy in the UK are subject to change between now and the Games. We will seek to keep any changes to a minimum.

- 1.20 Following the London Games, we will need to plan for the spectrum requirements of the Glasgow 2014 Commonwealth Games. We will consult separately on arrangements for the Glasgow Games in due course. Our approach will be informed by the views that we form in the light of responses to this consultation document.

### **Acknowledgements**

- 1.21 We are grateful for the advice and support we have received from members of the Spectrum Planning Group for the London 2012 Olympic Games and Paralympic Games (SPGOG) in our work to construct the draft spectrum plan contained in this document and on which we are now consulting.
- 1.22 We are also grateful to those stakeholders who gave us the benefit of their time and experience as we examined past Games and comparable events and finalised the draft spectrum plan. In particular, we wish to thank:
- the Agence nationale des fréquences (ANFR), France;
  - Arqiva;
  - the Australian Communications and Media Authority (ACMA);
  - the British Broadcasting Corporation;
  - the Bundesamt für Kommunikation, Switzerland;
  - members of the Federation of Communications Services;
  - the Fernmeldebehörde, Austria;
  - France Télévision;
  - Freedom 4;
  - Gigawave;
  - the Hellenic Communications and Post Commission (EETT), Greece;
  - Industry Canada;
  - the Joint Frequency Management Group;
  - Link Research;
  - the Ministry of Industry and Information Technology, China;
  - NHK Enterprises Europe;
  - Olympic Broadcasting Services (OBS);
  - Omega;
  - Plaintree Systems;
  - the Radio Society of Great Britain;

- Riedel Communications;
- SIS Outside Broadcasts;
- Société française de production;
- Total RF Productions;
- the Vancouver Organising Committee for the 2010 Olympic and Paralympic Winter Games (VANOC); and
- Wembley National Stadium.

### **UK Government endorsement**

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

UKSSC has been fully consulted with regard to this consultation document. It endorses the content and approach 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 Games.

## Section 2

# Introduction

## The London 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 Games 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 Games are also expected to attract 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 (see annex 5). There will be some 25 training venues in London, with a further 10 across the UK for football. Numerous other non-competition venues for the operation of the London 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 Games.
- 2.4 As well as the London 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 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 Games as well as in associated activities (e.g. cultural events).

## Purpose of this document

- 2.6 Ofcom is the independent regulator and competition authority for the UK communications industries, with responsibilities across television, radio, telecommunications and wireless communications services.
- 2.7 This document sets out our proposals for making spectrum available for wireless communications – and proposed high-level approaches to licensing/authorisation and interference management – at the London Games.

## Government guarantees

- 2.8 As part of London's bid for the 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.
- 2.9 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 Games.

2.10 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 Games.

2.11 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 consultation document as the Olympic Family):

- athletes;
- the IOC;
- LOCOG;
- national Olympic committees (NOCs);
- international federations of sport;
- the media;
- rights-holding broadcasters (RHBs); and
- Olympic partners (i.e. sponsors).

2.12 In accordance with these guarantees, we are responsible for organising a full spectrum plan for the London Games and for arranging all the licences for guaranteed users in good time in support of the plan.

2.13 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 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, emergency and public-safety 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 Games are met and coordinated with other uses.

## **Spectrum management**

2.14 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.

- 2.15 Our statutory duties, set by the Communications Act 2003,<sup>3</sup> include a requirement to secure the optimal use of spectrum in the interests of citizens and consumers. It is essential that the regulatory regime for spectrum responds to changes in demand for, and use of, spectrum in the UK.
- 2.16 Generally, our vision for spectrum management, as set out in the Spectrum Framework Review,<sup>4</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.
- 2.17 The London 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.
- 2.18 It is for these reasons that we started the task of spectrum planning for the London Games in 2006, some six years before they begin, before the Beijing 2008 Olympic Games and Paralympic Games took place and far earlier than any other host spectrum regulator. Such long lead times inevitably increase the uncertainty with which we must contend, particularly in accurately assessing the spectrum requirements of the Games. But 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 Games.

### **Authorising spectrum use**

- 2.19 Effective authorisation arrangements will be essential to ensure spectrum use for the London Games is efficient and properly coordinated and the risk of harmful interference is minimised.
- 2.20 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>5</sup> and
  - by granting such licences.
- 2.21 Under section 8(1) of the Act, it is an offence to establish, install or use equipment to transmit 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.

---

<sup>3</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>4</sup> [www.ofcom.org.uk/consult/condocs/sfr/sfr2/sfr.pdf](http://www.ofcom.org.uk/consult/condocs/sfr/sfr2/sfr.pdf).

<sup>5</sup> [www.opsi.gov.uk/acts/acts2006/pdf/ukpga\\_20060036\\_en.pdf](http://www.opsi.gov.uk/acts/acts2006/pdf/ukpga_20060036_en.pdf).

## Economic and financial considerations

2.22 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.

2.23 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>6</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.

2.24 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.

2.25 The Government's response stated that:<sup>7</sup>

We will apply administrative incentive pricing where spectrum has not been auctioned.

2.26 In addition, the Independent Audit of Spectrum Holdings, also by Professor Cave, concluded that:<sup>8</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.

2.27 The Government response and action plan agreed:<sup>9</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.

2.28 Consistent with the duties, principles and policies set out above, we believe that, where fees for spectrum users at the London 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.

---

<sup>6</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).

<sup>7</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>8</sup> [www.spectrumbauidit.org.uk/pdf/20051118%20Final%20Formatted%20v9.pdf](http://www.spectrumbauidit.org.uk/pdf/20051118%20Final%20Formatted%20v9.pdf).

<sup>9</sup> [www.spectrumbauidit.org.uk/pdf/governmentresponse.pdf](http://www.spectrumbauidit.org.uk/pdf/governmentresponse.pdf).

## Governance

- 2.29 Both UKSSC and the Olympic Board have responsibilities and expertise of direct relevance to spectrum planning for the London Games.
- 2.30 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.
- 2.31 UKSSC is jointly chaired by the Department for Business, Enterprise and Regulatory Reform (BERR) and MOD. Membership is open to Government departments and their agencies plus Ofcom and the devolved administrations.
- 2.32 The Olympic Board provides oversight, strategic coordination and monitoring of the London 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 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>10</sup>
- 2.33 Recognising the roles of these two bodies, SPGOG was established in January 2007 to support us in meeting our responsibilities toward the London Games. Although formally a subcommittee of UKSSC, its membership extends to and beyond those represented on the Olympic Board. SPGOG's terms of reference are at annex 6.
- 2.34 It should be noted that the Secretary of State has the power under the Communications Act to give us directions in respect of our spectrum-management functions, including 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.

## Discussion document

- 2.35 Our 2007 discussion document on our approach to spectrum planning for the London Games set out our analysis at that time of the spectrum requirements of the 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 the draft spectrum plan contained in this document and on which we are now consulting.

---

<sup>10</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).

- 2.36 We are grateful to those stakeholders who responded to the questions raised in the discussion document. Non-confidential responses,<sup>11</sup> as well as a summary,<sup>12</sup> are available from our website.
- 2.37 This document benefits from and draws on both the discussion document itself and responses to it in setting out proposals for consultation.

### Structure of this document

- 2.38 Section 3 sets out our approach to spectrum planning for the London Games and considers the demand for and supply of spectrum.
- 2.39 Section 4 sets out the assumptions we have made for the purposes of this consultation document and our reasoning for them. It then summarises the conclusions we have drawn in constructing the draft spectrum plan for the London Games in the light of these assumptions and the demand and supply assessments set out in section 3.
- 2.40 Section 5 sets out our assessment and proposals for spectrum for PMR – land radio and maritime radio.
- 2.41 Section 6 sets out our assessment and proposals for spectrum for audio links – wireless microphones, in-ear monitors (IEMs), talkback and audio distribution services (ADS).
- 2.42 Section 7 sets out our assessment and proposals for spectrum for video links – wireless cameras and point-to-point links.
- 2.43 Section 8 sets out our assessment and proposals for other guaranteed services – satellite services, telemetry and telecommand and wireless local-area networks (WLANs).
- 2.44 Section 9 sets out our assessment and proposals for spectrum at the six football venues.
- 2.45 Section 10 sets out our assessment and proposals for spectrum for cultural events – the torch relays, the Opening and Closing Ceremonies, team-welcome ceremonies, medal/victory ceremonies and other events and celebrations.
- 2.46 Section 11 considers services that require spectrum for the London Games but fall outside the Government's guarantees to the IOC and sets out how they will need to secure use of the spectrum they need.
- 2.47 Section 12 sets out our role in supporting innovation at, and delivery of a legacy to, the London Games.
- 2.48 Section 13 sets out proposed high-level approaches to licensing/authorisation and interference management for the London Games drawing on our own and other spectrum regulators' experiences of past Games and comparable events.
- 2.49 Section 14 sets out the relevance for spectrum management of the test events that will take place leading up to the London Games.

---

<sup>11</sup> [www.ofcom.org.uk/consult/condocs/spectrum2012/responses/](http://www.ofcom.org.uk/consult/condocs/spectrum2012/responses/).

<sup>12</sup> [www.ofcom.org.uk/consult/condocs/spectrum2012/statement/statement.pdf](http://www.ofcom.org.uk/consult/condocs/spectrum2012/statement/statement.pdf).

2.50 Section 15 sets out next steps.

### **Impact assessment**

2.51 At this stage, we have not conducted a full impact assessment. This is because we are consulting on a draft spectrum plan to meet the guarantees the Government has already given to the IOC on the allocation of the frequencies required for the organisation of the London Games. Nonetheless, throughout this consultation document, we have made qualitative assessments where we have sufficient information to do so.

### **Demand**

2.52 We have identified that different services will require different amounts of spectrum and use different frequencies with different requirements to prevent harmful interference. In section 3, we consider how to assess:

- user requirements and the services that will generate them;
- technology changes that might affect those requirements;
- how those requirements might be reduced with no loss of benefit; and
- the suitability and availability of spectrum to meet those requirements.

2.53 We have also considered the impact on the opportunity cost of, and demand for, spectrum of relying more heavily on wired communications.

### **Supply**

2.54 Because of the scale of the spectrum demand generated by the London Games, alongside business-as-usual requirements that are already high in the capital, we have considered supplying spectrum from three sources:

- civil spectrum;
- public-sector spectrum holdings; and
- licence-exempt spectrum.

### **Assessments**

#### PMR

2.55 We set out our assessment for land radio in paragraphs 5.4-5.5 and for maritime radio in paragraphs 5.23-5.25.

#### Audio links

2.56 We set out our assessment for wireless microphones and IEMs in paragraphs 6.5-6.6 and for talkback in paragraph 6.15.

### Video links

- 2.57 We set out our assessment for wireless cameras in paragraphs 7.3-7.8 and for point-to-point links in paragraphs 7.16-7.17.

### Other guaranteed services

- 2.58 We set out our assessment for fixed satellite services in paragraphs 8.5 (permanent earth stations) and 8.9 (transportable earth stations), for mobile satellite services in paragraph 8.16, for radionavigation satellite services in paragraph 8.19, for telemetry and telecommand in paragraph 8.23 and for WLANs in paragraph 8.28.

### Football venues

- 2.59 We set out our assessment for the football venues in paragraphs 9.2-9.3.

### **Conclusion**

- 2.60 We broadly conclude that we expect there to be no negative impact on citizens or consumers, and we do not anticipate revoking or varying existing licences to meet the requirements of the London Games. If our assessments of demand and supply change, we may be required to do so. We do anticipate having to impose some restrictions on business-as-usual spectrum use for PMSE at times and in locations of peak Games demand. We will, of course, endeavour to keep these restrictions to the minimum necessary.
- 2.61 We will reconsider the impact of our proposals in the light of responses to this consultation document.

## Section 3

# Approach

## Introduction

- 3.1 Our approach to spectrum planning for the London Games can be broken down into a number of tasks:
- identifying users who might require spectrum for the Games;
  - identifying more accurately users covered by the Government's spectrum guarantees;
  - assessing user requirements and the services that will generate them;
  - assessing technology changes that might affect those requirements;
  - assessing how those requirements might be reduced with no loss of benefit;
  - assessing the suitability and availability of spectrum to meet those requirements;
  - constructing a draft spectrum plan for consultation, ongoing refinement and implementation;
  - putting in place with the relevant bodies financial and management arrangements for access to the spectrum they manage; and
  - assessing the potential impact of changes to broader spectrum policy in the UK.

## Demand

### Introduction

- 3.2 Accurately assessing demand is difficult this far in advance of the London Games for three main reasons:
- not all users (e.g. RHBs and partners) have been selected or identified;
  - many known users are involved with the Vancouver 2010 Winter Olympic Games and Paralympic Games and have not yet considered their requirements for the London Games; and
  - technological developments cannot reliably be foreseen, and technology choices have not yet been made. We have not attempted to second-guess such developments and choices in this consultation document. Instead, we have taken into account existing availability of equipment on the market.
- 3.3 Nevertheless, assessing demand is very important. Different services will require different amounts of spectrum and use different frequencies with different requirements to prevent harmful interference. This will affect their ability to share spectrum at the same time in the same location with other services. We will need to accommodate services that are not yet common but might be by the time of the

London Games. And we will need to decide how to deal with wireless equipment brought into the UK by users accustomed to using it overseas, where technical standards may differ.

- 3.4 We have therefore taken three different approaches to assessing demand and the services that will generate it. We have used the combined results to inform our estimates of demand, which are set out in sections 5 to 9.

## Approaches

### Top-down approach

- 3.5 This approach examines demand at past Games and comparable events. The most useful comparators to the London Games are:
- the Sydney 2000 Olympic Games and Paralympic Games;
  - the Manchester 2002 Commonwealth Games;
  - the Salt Lake 2002 Winter Olympic Games and Paralympic Games;
  - the Athens 2004 Olympic Games and Paralympic Games;
  - the Melbourne 2006 Commonwealth Games;
  - the Turin 2006 Winter Olympic Games and Paralympic Games;
  - the Beijing Games; and
  - recent Tours de France, FA Cup finals, FIFA World Cups and IRB World Cups.
- 3.6 We will also learn as much as we can from the Vancouver Games and the Delhi 2010 Commonwealth Games.
- 3.7 Examining demand at these events reveals a general increase over time as more extensive use is made of wireless services. It might therefore be reasonable to assume that demand at the London Games will be higher than at past Games. The large number of different competition venues that will be used for the London Games will exacerbate this trend.
- 3.8 Moreover, the Information Age Partnership noted:<sup>13</sup>
- In gauging the spectrum required, it is important not simply to extrapolate from previous Games. The 2012 Games – characterised by digital content, IP connectivity and seamlessness – will create an unprecedented level of demand for spectrum. It is essential that the work underway to gauge the likely demand and propose the means by which it may be satisfied progresses rapidly and in close engagement with industry.

---

<sup>13</sup> [www.iapuk.org/files/2012\\_Paper\\_160507.pdf](http://www.iapuk.org/files/2012_Paper_160507.pdf).

### Bottom-up approach

- 3.9 This approach attempts to assess demand for each service associated with each class of user. Our assessment can only be as good as the information available to us. Obtaining relevant and reliable information is challenging given that many users are not yet focusing on the London Games.
- 3.10 We are working closely with LOCOG and have discussed demand for broadcasting with OBS and major RHBs. We will incorporate information from potential users as they turn their attention from the Vancouver Games to the London Games.
- 3.11 Despite its inherent difficulties, we expect the bottom-up approach to deliver the best assessment of demand at the London Games as it is most likely to capture factors unique to those Games.

### Theoretical approach

- 3.12 This approach looks at guidance on demand for programme-making at large events. Reports from the European Radiocommunications Committee (ERC) and the Electronic Communications Committee (ECC) of the European Conference of Postal and Telecommunications Administrations include:
- ERC Recommendation 70-03 relating to the use of short-range devices;<sup>14</sup>
  - ERC Recommendation 25-10 relating to frequency ranges for the use of temporary terrestrial audio and video SAP/SAB links (incl. ENG/OB);<sup>15</sup>
  - ERC Report 33 – the use of radio frequencies above 20 GHz for fixed services and ENG/OB;<sup>16</sup>
  - ERC Report 38 – handbook on radio equipment and systems video links for ENG/OB use;<sup>17</sup>
  - ERC Report 42 – handbook on radio equipment and systems radio microphones and simple wide band audio links;<sup>18</sup> and
  - ECC Report 2 – SAP/SAB (incl. ENG/OB) spectrum use and future requirements.<sup>19</sup>
- 3.13 The reports provide a useful starting point for the London Games. While particular aspects are substantially different (e.g. the distinction between host broadcaster and RHBs will affect levels of equipment use), an estimate of spectrum requirements based on this guidance can be used as a high-level crosscheck.

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

<sup>14</sup> [www.ero.dk/doc98/official/pdf/rec7003e.pdf](http://www.ero.dk/doc98/official/pdf/rec7003e.pdf).

<sup>15</sup> [www.ero.dk/documentation/docs/doc98/official/pdf/rec2510e.pdf](http://www.ero.dk/documentation/docs/doc98/official/pdf/rec2510e.pdf).

<sup>16</sup> [www.ero.dk/documentation/docs/doc98/official/pdf/rep033.pdf](http://www.ero.dk/documentation/docs/doc98/official/pdf/rep033.pdf).

<sup>17</sup> [www.ero.dk/documentation/docs/doc98/official/pdf/rep038.pdf](http://www.ero.dk/documentation/docs/doc98/official/pdf/rep038.pdf).

<sup>18</sup> [www.ero.dk/documentation/docs/doc98/official/pdf/rep042.pdf](http://www.ero.dk/documentation/docs/doc98/official/pdf/rep042.pdf).

<sup>19</sup> [www.ero.dk/documentation/docs/doc98/official/pdf/eccrep002.pdf](http://www.ero.dk/documentation/docs/doc98/official/pdf/eccrep002.pdf).

## Reducing demand

- 3.14 The London Games will bring significant economic and social benefits to the UK. But, as with any other scarce resource, using spectrum to realise these benefits comes at a cost. In particular, there will be an opportunity cost because other services of value to society are denied use of the same spectrum. London is the most congested part of the UK for spectrum use, which therefore carries a high opportunity cost even in normal circumstances. The requirements of the Games will increase that cost. We want to minimise it while meeting the Government's spectrum guarantees.
- 3.15 One way to reduce that opportunity cost is to reduce demand, particularly by relying more heavily on wired communications. This is considered below. We set out our views of its implications in our proposals for wireless cameras in section 7.

### Relying more heavily on wired communications

- 3.16 We noted in our discussion document that manufacturers have developed fixed and mobile optical-fibre cameras in response to the introduction of high definition (HD). High-bandwidth optical fibre can carry many video streams over a single link, and the costs associated with installation have fallen. It is therefore possible to rely more heavily on wired communications, substituting for spectrum use, than has previously been the case.
- 3.17 With this in mind, we commissioned Analysys Mason to study the potential to use wired technology where the host organising committee and broadcast operations for the Olympic Games and Paralympic Games typically use wireless technology at present. We have published its report alongside this consultation document.<sup>20</sup> In summary, it found that:
- there is some opportunity for providing underground ducts and wired access points to enable the use of wired instead of wireless cameras, but this would realise only a limited reduction in spectrum demand;
  - the use of fixed receive points for wireless cameras operating at 2-3 GHz in conjunction with fibre transmission, either within a venue or over a wider area, is already well established in sports and ENG broadcasts. This could realise significant reductions in spectrum demand if extended to wireless cameras operating at higher frequencies, particularly 3-7 GHz and potentially even 60 GHz; and
  - the best opportunity for reducing spectrum demand is to deploy a London-wide cellular receive system in which fixed receive points are set up around the city and connected into a fibre network. This system could be applied to wide-area sports and ENG broadcasts in central London to eliminate the need for aerial relays of signals back to a studio or the IBC in the Olympic Park.
- 3.18 We commissioned Analysys Mason to conduct a follow-up study of the second and third of these possibilities for relying more heavily on wired communications to allow the trade-off between effective spectrum planning and the estimated costs and risks of their implementation to be assessed. We have published this report, too, alongside this consultation document.<sup>21</sup> In summary, it finds that:

---

<sup>20</sup> [www.ofcom.org.uk/consult/condocs/london2012/wire\\_wireless.pdf](http://www.ofcom.org.uk/consult/condocs/london2012/wire_wireless.pdf).

<sup>21</sup> [www.ofcom.org.uk/consult/condocs/london2012/wire\\_wireless2.pdf](http://www.ofcom.org.uk/consult/condocs/london2012/wire_wireless2.pdf).

- fibre-wireless networks are currently used to good effect by broadcasters and are likely to be the solution of choice in venues that require wireless-camera reception. If so, there is little scope to improve spectrum efficiency. However, using higher frequencies (especially up to 7 GHz) for stadium applications would benefit spectrum planning; and
- a London-wide network suitable for use by wireless cameras operating at up to 2.5 GHz is deliverable and could reduce the requirement for simultaneous use by up to 15 channels.

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

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

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

## Supply

### Introduction

3.19 No spectrum is set aside in the UK specifically for events comparable to the London Games. Instead, this could be supplied from three sources:

- civil spectrum;
- public-sector spectrum holdings; and
- licence-exempt spectrum.

3.20 Because of the scale of the spectrum demand generated by the London Games, alongside business-as-usual requirements that are already high in the capital, we have considered supplying spectrum from all three of these sources. Our proposals for matching this supply to demand are set out in sections 5 to 9.

### Sources

#### Civil spectrum

3.21 All of the wireless services required by the London Games operate to some extent on a business-as-usual basis in the UK. We have therefore looked at the ability of the spectrum that they already use to meet the requirements of the Games.

3.22 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. This, too, is a possibility for the London Games. However, under paragraph 8(5) of Schedule 1 to the Wireless Telegraphy Act, 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 section 2, 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.

### *Land mobile radio*

- 3.23 Spectrum used for land mobile radio (e.g. 450-470 MHz) is heavily congested in London. It is also used extensively for talkback. Any significant use of these bands for the London Games is likely to affect other users.

### *Maritime radio*

- 3.24 There is currently unused capacity within the spectrum used for maritime radio in the Weymouth Bay/Portland Harbour area, although this could become scarce between now and the Games. Some of this capacity has already been coordinated with France, and we anticipate licensing it to LOCOG pending a full assessment of its requirements for the sailing events taking place there.

### *Audio and video links*

- 3.25 Some 2.5 GHz of spectrum in 75 distinct bands between 47.55 MHz and 48.4 GHz is currently allocated for SAP/SAB (also known as PMSE) in the UK. But the amount that is readily usable is constrained by the preponderance of equipment in the UHF band – primarily 470-862 MHz for wireless microphones and 2-3 GHz for wireless cameras.
- 3.26 We plan to award much of this spectrum in the next year or so to a band manager with obligations to meet reasonable demand from PMSE users on fair, reasonable and nondiscriminatory terms until 2018.<sup>22</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 Games.<sup>23</sup> Applicants for the licence will need to take account of this along with any requirements to ensure efficient coordination between shared Games and non-Games use of the same spectrum. This is addressed in section 13.
- 3.27 To maximise the supply of spectrum for the Games, we have also proposed deferring the start date for rights to use the UK's digital dividend – the spectrum being freed up for new uses by the switchover from analogue to DTT – in London until they have concluded.<sup>24</sup>

### Public-sector spectrum holdings

- 3.28 Significant amounts of spectrum are managed by UK public-sector bodies. In particular, MOD, CAA and MCA manage spectrum essential for defence, security and safety purposes that is also suitable for temporary use for the London Games.
- 3.29 The Government has already indicated in its Forward Look 2009 that:
- Ofcom's objective is to ensure that the UK meets its commitment to make spectrum available for the London Games at minimum cost to UK citizens and consumers. It is therefore intended that the requirements of the Games will wherever possible be met from within bands managed by the public sector, notably the MOD.
- 3.30 This must be seen in the context of the Government's commitment to reforming public-sector spectrum management, including introducing spectrum trading to

---

<sup>22</sup> [www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf](http://www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf).

<sup>23</sup> [www.ofcom.org.uk/consult/condocs/bandmgr/condoc.pdf](http://www.ofcom.org.uk/consult/condocs/bandmgr/condoc.pdf).

<sup>24</sup> [www.ofcom.org.uk/consult/condocs/800mhz/800mhz.pdf](http://www.ofcom.org.uk/consult/condocs/800mhz/800mhz.pdf).

enable public-sector bodies to interact with the market, as also set out in Forward Look 2009.

### Licence-exempt spectrum

- 3.31 Some spectrum that could meet demand at the London Games can be used on a licence-exempt (i.e. unlicensed) basis.

### **Monitoring**

- 3.32 We are currently monitoring spectrum use at a number of locations to verify and/or better understand levels of interference to spectrum that we believe can be made available for the London Games. We will continue to do so in the run-up to the Games to assess how changes to the built environment, especially in the Olympic Park itself, change propagation and the ability to reuse spectrum.

### **Spectrum used overseas for special events**

- 3.33 We have studied how spectrum is used to support special events overseas. This has provided indications of:
- what spectrum those bringing equipment into the UK might wish to use (e.g. the 10.3-10.6 GHz band is used for wireless cameras in Japan); and
  - how spectrum might be used differently compared to normal practice in the UK (e.g. fixed-trajectory wireless cameras operating at 60 GHz at the Turin Games).
- 3.34 This has informed elements of the draft spectrum plan contained in this consultation document. It will also contribute to our understanding of whence sources of harmful interference may arise in carrying out field operations during the London Games.

### **Maximising supply**

- 3.35 The supply of spectrum can be maximised by using it more efficiently, reusing it efficiently and using higher frequencies than usual. These opportunities are considered below. We set out our views of their implications in our proposals for audio links in section 6 and wireless cameras in section 7.

### Using spectrum more efficiently

- 3.36 We noted in our discussion document that many applications use spectrum in line with practices born of long experience, particularly where close coordination between users is needed to avoid harmful interference. Examples include the deployment patterns of wireless microphones and cameras at special events and outside broadcasts. These practices have evolved for good reasons, and they generally serve users well.
- 3.37 We expect the London Games to give rise to spectrum requirements unprecedented in their scale and complexity for a single event. Existing practices might be unsuited to these circumstances. New behaviours might be needed instead. These, in turn, will be influenced by the environment of Games venues, particularly in their suitability for spectrum to be reused.

### *Wireless microphones*

3.38 We commissioned CSMG to analyse how wireless microphones, IEMs and talkback systems could make more efficient use of spectrum. We published its report on 19 February 2009.<sup>25</sup> In summary, it found that:

- 470-862 MHz (UHF Bands IV and V) will remain critical in the period to the London Games; but
- for some uses (e.g. short-range camera audio), higher-frequency spectrum could start to be used by the London Games; and
- overall, there are opportunities for improvements in wireless-microphone technology (notably digital transmission systems) to improve spectrum efficiency.

### *Wireless cameras*

- 3.39 Simultaneous use of the same spectrum without harmful interference is impossible when equipment is co-located unless the technology employed (e.g. dynamic frequency selection) or user behaviour facilitates this. Co-channel use is possible when a minimum distance between transmitters is achieved. This separation distance is a function of the radiated power and receiver characteristics.
- 3.40 The distance can also be reduced by offsetting the centre frequency of one of the channels being used. As the centre-frequency offset increases, the distance between the interferer and the victim reduces (all things being equal). It is therefore possible that offsetting the channels used by wireless cameras from one venue to another would allow more efficient use of the spectrum.
- 3.41 Practicality is an important consideration here. We understand most wireless cameras can be tuned in 1 MHz increments, but this may not be the case for all. Offsetting could also complicate licensing processes as each venue could end up with a different offset, making it more complicated to move equipment between venues or to protect against harmful interference from airborne use. It may therefore not be appropriate to all deployment scenarios.

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

### Reusing spectrum efficiently

- 3.42 It is not necessary to protect wireless services used at the London Games from harmful interference outside their required area of operation. Most services (e.g. wireless microphones and cameras) will only need to operate over short distances, between the transmitter and its associated receiver. In many cases, these will be restricted to a venue, possibly extending to back-of-house facilities as well.
- 3.43 The principles for establishing the required protection distances could be:
- estimate the wanted signal at the edges of desired reception using free-space path loss;
  - build in a fade margin; and

<sup>25</sup> [www.ofcom.org.uk/radiocomms/ddr/documents/wirelessmics.pdf](http://www.ofcom.org.uk/radiocomms/ddr/documents/wirelessmics.pdf).

- add the relevant carrier-to-interference protection.

3.44 We have predicted path losses between the Olympic Park and other venues using two different software tools. Both produced the same result to within  $\pm 3$  dB. The model parameters used were:

- ITU-R P1546-3 – 50% of time and 50% of locations, with both receive and transmit antenna at the same height; and
- ITU-R P452 – 10% availability, with both receive and transmit antenna at the same height.

3.45 The detailed results are set out in table 1 below.

**Table 1. Predicted path losses between the Olympic Park and other venues (dB)**

Frequency	Propagation model	Antenna height	Broxbourne	Earl's Court	Eton Dorney	ExCeL Exhibition Centre	Horse Guards Parade	Hyde Park	Lord's Cricket Ground
170 MHz	ITU-R P1546-3	10 m	155.09	132.15	157.95	108.33	125.49	129.16	120.07
350 MHz			163.21	140.05	165.36	115.04	133.33	136.96	127.48
450 MHz			166.04	142.80	167.93	117.38	136.07	139.67	130.05
600 MHz		1.5 m	187.79	170.05	191.47	142.58	166.59	166.68	152.07
800 MHz			193.33	174.41	196.66	146.22	170.87	170.91	155.93
1 GHz	ITU-R P452	10 m	176.49	151.13	177.68	124.06	144.05	147.78	137.57
2 GHz			179.04	145.13	172.74	109.46	138.90	147.32	140.87
3 GHz			185.61	149.59	178.72	112.99	142.85	152.33	144.68
5 GHz			193.57	155.44	186.22	117.43	147.93	158.94	150.29
7.5 GHz			199.28	160.30	192.93	120.96	152.09	164.42	154.80
9 GHz			201.57	162.56	195.97	122.55	154.00	166.96	156.84

Frequency	Propagation model	Antenna height	Maritime Greenwich	North Greenwich Arena 1	Regent's Park	Royal Artillery Barracks	Wembley Stadium	Wimbledon
170 MHz	ITU-R P1546-3	10 m	109.05	106.03	121.38	109.53	138.37	132.72
350 MHz			115.95	112.56	128.85	116.46	146.22	140.45
450 MHz			118.35	114.83	131.45	118.88	148.95	143.13
600 MHz		1.5 m	139.61	140.07	154.72	140.01	174.85	166.67
800 MHz			143.13	143.67	158.64	143.54	179.37	170.96
1 GHz	ITU-R P452	10 m	125.12	121.38	139.05	125.67	157.62	151.48
2 GHz			113.76	108.13	144.24	114.46	162.97	140.59
3 GHz			117.28	111.66	148.55	117.99	168.35	143.93
5 GHz			121.73	116.10	153.96	122.43	175.09	148.08
7.5 GHz			125.26	119.63	158.81	125.97	180.44	151.33
9 GHz			126.86	121.22	161.18	127.56	182.84	152.97

3.46 All venues will have different propagation characteristics because of construction materials, seating arrangements and overall layout. As many venue designs have not yet been finalised, it is difficult to assess their impact. However, we understand some venues will be temporary in whole or in part, and the materials used in their construction may include metallic tubes that interconnect to form a mesh. In some cases, these would increase the building penetration loss and maybe even block electromagnetic fields (including radio frequencies). Materials providing shielding are also available on the market and could be used specifically to stop radiation coming into or out of a building. As a result, propagation into and out of the venue could be very poor, allowing possibly more efficient spectrum reuse.

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

### Using higher-frequency spectrum

- 3.47 We noted in our discussion document that much wireless-camera technology operates between 2 and 3 GHz. The propagation characteristics of this spectrum allow reasonably long-range communication links, including ground-to-air and air-to-ground relays, to be established.
- 3.48 At higher frequencies, the range that can be achieved for a given transmitter power and antenna gain is reduced. However, with a modest increase in power and the use of multiple receive antennas in a diversity arrangement, it might be possible to exploit higher-frequency spectrum in addition or instead. The scope for this appeared to be greatest within venues, where communication distances are shorter and operational parameters can be more tightly controlled.
- 3.49 As well as reducing the cost of spectrum use, such developments could also allow access to significantly more bandwidth, and hence better video quality, than would otherwise be possible.
- 3.50 We commissioned Sagentia to consider the feasibility of wireless cameras using higher frequencies in the SHF (3-30 GHz) and EHF (30-300 GHz) bands. We published its report on 30 January 2008.<sup>26</sup> In summary, it found that:
- it would be feasible to implement system architectures which would accommodate the shorter range of 7.5 GHz versus 2.3 GHz in OB applications;
  - the greatest opportunity for using 7.5 GHz was in stadium OB applications. Some increase in power would be needed, and the number of receive antennas may also need to be increased. But the use of 7.5 GHz would allow greater frequency reuse than would be possible at 2.3 GHz; and
  - increased transmitter power and the use of multiple receive antennas may make the use of 60 GHz possible within stadia on the back of technology developments at this frequency. It may also be possible to deploy 60 GHz line-of-sight links in mobile-OB-to-helicopter and OB/ENG-helicopter-to-static-vehicle applications. However, existing applications at the time of the report were not sufficiently close to those of wireless cameras to make the technologies relevant in time for the London Games.
- 3.51 Wireless-camera technology that operates at up to 10 GHz is now increasingly available from manufacturers and used for sports and ENG broadcasts. 60 GHz products are also beginning to become available, although their potential role at the London Games remains unclear.

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

- 3.52 We understand that short terrestrial point-to-point links can also be achieved with free-space optics technologies that use infrared light. These do not suffer from radio interference, do not require a licence to operate and can meet communications needs where certain microwave links are not allowed (e.g. near airports). We understand such technologies are also very quick to set up.

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

<sup>26</sup> [www.ofcom.org.uk/consult/condocs/spectrum2012/shf\\_ehf/report.pdf](http://www.ofcom.org.uk/consult/condocs/spectrum2012/shf_ehf/report.pdf).

## Section 4

# Assumptions and summary conclusions

## Introduction

- 4.1 This section sets out the assumptions we have made for the purposes of this consultation document and our reasoning for them. It then summarises the conclusions we have drawn in constructing the draft spectrum plan for the London Games in the light of these assumptions and the demand and supply assessments set out in section 3.

## Assumptions

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

- 4.2 The first edition of the Olympic Delivery Authority's (ODA) transport plan for the London Games estimated that about 21,300 accredited media personnel will be present.<sup>27</sup>

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

- 4.3 Discussions with broadcasters and Analysys Mason's work indicate that wired technology is preferred where practicable because it is more reliable than wireless alternatives. This corroborates responses to our discussion document.
- 4.4 This means 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**

- 4.5 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.
- 4.6 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**

- 4.7 Again according to the first edition of ODA's transport plan, the Paralympic Village will close on 14 September 2012.

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

- 4.8 We understand this from discussions with broadcasters and spectrum regulators' experiences of past Games.

---

<sup>27</sup> [www.london2012.com/plans/transport/getting-ready/transport-plan.php](http://www.london2012.com/plans/transport/getting-ready/transport-plan.php).

## **VI. Wireless equipment will be retuneable to some extent**

- 4.9 We understand this from discussions with broadcasters, spectrum regulators' experiences of past Games, our experience of the London stages of the 2007 Tour de France and business-as-usual practice in the UK.
- 4.10 Most broadcasters to whom we have spoken indicated they could retune their own equipment or hire other equipment if given sufficient notice.

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

- 4.11 This is based on best practice in spectrum management, our understanding of past Games and comparable events and CEPT reports (especially 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 at most, with 50 mW EIRP sufficing in most cases; 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**

- 4.12 Wireless microphones will generally use 200 kHz channels (although, in some countries, this can be 125-140 kHz).
- 4.13 The bandwidth for IEMs can reach up to 300 kHz.
- 4.14 Talkback typically uses 12.5 kHz channels.
- 4.15 10 MHz is the channel width typically allocated to wireless cameras by spectrum regulators. 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 LMS-T modulation uses 9.4 MHz, giving additional throughput.

## **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**

- 4.16 All wireless equipment used at the London Games will need to comply with the Radio Equipment and Telecommunications Terminal Equipment Regulations 2000,<sup>28</sup> as amended.<sup>29</sup> These implement the European Union Radio and Telecommunications Terminal Equipment (R&TTE) Directive.<sup>30</sup>

<sup>28</sup> [www.opsi.gov.uk/si/si2000/uksi\\_20000730\\_en.pdf](http://www.opsi.gov.uk/si/si2000/uksi_20000730_en.pdf).

<sup>29</sup> [www.opsi.gov.uk/si/si2003/uksi\\_20031903\\_en.pdf](http://www.opsi.gov.uk/si/si2003/uksi_20031903_en.pdf) and [www.opsi.gov.uk/si/si2003/uksi\\_20033144\\_en.pdf](http://www.opsi.gov.uk/si/si2003/uksi_20033144_en.pdf).

<sup>30</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:091:0010:0028:EN:PDF>.

4.17 IRs provide a link between the requirements of the R&TTE Directive and the use of spectrum. UK IRs describe the minimum technical specifications (e.g. power limits, frequency bands and channel spacing) necessary to avoid harmful interference between wireless services. In particular, IR 2000 sets out the requirements for point-to-point links,<sup>31</sup> and IR 2038 contains the requirements for licensing and using wireless equipment for PMSE.<sup>32</sup>

4.18 Further information about the R&TTE Directive is available on our website.<sup>33</sup>

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

4.19 OBS was created by the IOC in May 2001 to ensure high standards of broadcasting are maintained over successive Games. It will serve as host broadcaster for the London Games. As such, it is chiefly responsible for providing pictures and images of the Games as a service to all RHBs.

4.20 OBS's specific duties are to:

- produce the international television and radio signals of the Games;
- design, build, install, operate and then dismantle the IBC;
- design, build, install, operate and then remove facilities and equipment at competition and select non-competition venues other than the IBC;
- coordinate and provide various facilities and services to RHBs;
- represent the needs of RHBs to the local organising committee regarding a variety of facilities and services; and
- produce various features and maintain an Olympic archival service.<sup>34</sup>

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

4.21 We understand contracts have so far been agreed with ASBU (Middle East), CCTV (China), Channel 9 (Australia), CTV (Canada), EBU (Europe), NBC (United States), SBS (Korea), Sky Italia (Italy) and TV Record (Brazil).<sup>35</sup>

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

4.22 OBS has indicated that most feeds will be in HD, although some RHBs will still want to receive this in standard definition. This corroborates responses to our discussion document.

---

<sup>31</sup> [www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/IR2000.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/IR2000.pdf).

<sup>32</sup> [www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/ir2038.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/ir2038.pdf).

<sup>33</sup> [www.ofcom.org.uk/radiocomms/ifi/tech/RTEE/](http://www.ofcom.org.uk/radiocomms/ifi/tech/RTEE/).

<sup>34</sup> [www.obs.es/introduction.html](http://www.obs.es/introduction.html).

<sup>35</sup> [www.olympic.org/uk/organisation/facts/broadcasting/index\\_uk.asp](http://www.olympic.org/uk/organisation/facts/broadcasting/index_uk.asp).

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

- 4.23 We understand this from initial discussions with OBS but will seek greater clarity nearer the time of the London Games.

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

- 4.24 The laws of physics determine that propagation is better at lower frequencies, all other things being equal. Responses to our discussion document nonetheless highlighted that, with strict power limits, spectrum at 7 GHz could be used within venues, which might permit reuse in other locations.

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

- 4.25 Adjacent-channel use is possible especially when all systems use similar radiated power. In most venues, 100 mW is sufficient to achieve the desired link. Within venues, the distance from the wanted receiver to the wanted transmitter is similar to the distance to an unwanted transmitter. Keeping the required ratio between wanted and unwanted signal strength and reducing overall noise will therefore ensure successful operation. Some broadcasters have successfully used adjacent channels in these circumstances at past Games or comparable events.
- 4.26 At higher power levels, both the level of interference received in adjacent channels and the noise floor will increase. At and above 1 W, adjacent-channel use will only be possible if all wireless cameras in the vicinity use similar power and there is broadly the same distance between receivers and wanted transmitters. If this is not the case, a guard band of a size related to the power used by both systems will be required to ensure a channel can be used without harmful interference.

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

- 4.27 Although OBS may contract for the provision of live video feeds in some venues, we foresee it remaining the licensee for spectrum use and so having a full view of requirements across all venues. This will mean we have only one contact point with which to communicate, assist our understanding of spectrum use and, in some cases, allow better spectrum reuse.

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

- 4.28 We understand this from discussions with broadcasters and manufacturers and from Analysys Mason's work.

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

- 4.29 Some RHBs will want to capture their own content (e.g. following certain athletes rather than relying on a neutral feed). Generally, OBS will offer physical space in competition venues to enable them to do this. We therefore anticipate they will need to transport those feeds back to the IBC, to temporary studios in OB trucks or to other studios.

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

4.30 We understand from LOCOG that this will be used for its technology requirements and is not the broadcast solution.<sup>36</sup>

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

4.31 We understand this was typical at past Games.

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

4.32 On 26 January 2009, LOCOG confirmed that Airwave had become the latest Tier Three Supplier to the London Games and would provide PMR services for use within all competition venues and critical operational venues and across the Olympic Route Network (ORN).<sup>37</sup>

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

4.33 Use of CTCSS tones/DCS codes will ensure PMR users do not hear unwanted communications and/or noise from other users. Moreover, a single channel may be used for multiple talk groups, with each being given a different tone. This will increase the opportunities to reuse spectrum.

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

4.34 Satellite uplinks have been deployed at past Games to allow broadcasters to send feeds back to their country of origin.

4.35 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.

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

4.36 We understand this is business-as-usual practice.

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

4.37 We understand this is business-as-usual practice.

---

<sup>36</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).

<sup>37</sup> [www.london2012.com/news/media-releases/2009-01/airwave-named-as-london-2012-tier-three-supplier.php](http://www.london2012.com/news/media-releases/2009-01/airwave-named-as-london-2012-tier-three-supplier.php).

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

- 4.38 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 test equipment with the London Games in mind. Other events, organised by LOCOG, will take place in clusters of venues that will be closer to the reality of the 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 Games**

- 4.39 LOCOG and its technology partners 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.

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

- 4.40 Discussions with broadcasters suggest that, while not typical practice, they could use specific frequencies in a venue only at specific times if given sufficient and sufficiently clear notice.

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

- 4.41 Key factors that might trigger changes to the spectrum plan include:
- the results of our monitoring activities;
  - ongoing discussions with likely spectrum users both at the London Games and for business as usual;
  - 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.

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

## Draft spectrum plan

- 4.42 In the light of the demand and supply assessments and the assumptions set out above, we have constructed the draft spectrum plan for the London Games that is contained in the rest of this document and on which we are now consulting.
- 4.43 We have deliberately focused on London itself as that is where most Games venues will be, spectrum demand will be highest and spectrum supply is at a particular premium. We have nonetheless assessed the specific requirements of the five football venues elsewhere in the UK and looked in particular detail at the needs of the sailing events at Weymouth Bay/Portland Harbour.
- 4.44 In seeking to match supply to demand so as to minimise any negative impact on other spectrum users and, ultimately, on citizens and consumers who benefit from those uses, we have sought first to make use of unencumbered spectrum, then to share with existing users and only in the last resort to place restrictions on, or take spectrum back from, existing users.
- 4.45 Some spectrum could be used by different services but not at the same time in the same location. Where this is the case, we will ultimately need to prioritise use, in close coordination with LOCOG.
- 4.46 In summary:
- PMR – LOCOG intends to provide services to members of the Olympic Family through a contract with Airwave using spectrum secured through existing allocation and assignment processes. If this opportunity is taken up by organisations that would normally provide their own PMR handsets, we will need to cater for only a limited number of relatively small users who insist on their own systems and for PMR-type talkback systems.
  - wireless microphones – as noted above, most will only operate in UHF Bands IV and V, sharing with analogue and DTT. We believe 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; and
  - wireless cameras – UK public-sector bodies (notably MOD, CAA and MCA) have committed to allow use of some of the spectrum they manage for temporary use for the Games subject to necessary coordination arrangements. This means we should be able to satisfy demand at frequencies commonly used by broadcasters and/or for which equipment is readily available. 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 to encourage this.
- 4.47 At present, we do not anticipate revoking or varying existing licences to meet the requirements of the London Games. If our assessments of demand and supply change, we may be required to do so. We do anticipate having to impose some restrictions on business-as-usual spectrum use for PMSE at times and in locations of peak Games demand. We will, of course, endeavour to keep these restrictions to the minimum necessary.
- 4.48 Where, following this consultation, we conclude it is unlikely we will make a particular band available for the Games, we will say so in the statement we intend to publish by

the end of 2009. Again, if our assessments of demand and supply change, we may be required to use such bands and the statement will not fetter our discretion to do so in accordance with appropriate procedures.

## **Terminology**

4.49 In the following sections:

- the Olympic Park encompasses all the venues on the 500-acre site in the Lower Lea Valley;
- the River Zone encompasses the five main venues in the Thames Gateway area straddling the River Thames; and
- the Central Zone encompasses all the remaining venues within Greater London.

## Section 5

# Private mobile radio

## Introduction

- 5.1 This section sets out our assessment and proposals for spectrum for PMR – land radio and maritime radio.

## Land radio

- 5.2 LOCOG has contracted with Airwave to provide it with land-radio services. These will use spectrum secured through existing allocation and assignment processes and/or agreements with public-sector bodies. The Airwave network is expected to cover all competition and other key operational venues as well as the ORN.
- 5.3 Because LOCOG has already secured the provision of its land-radio services, we have assumed it has no further requirements and have therefore only assessed those of other users covered by the Government's spectrum guarantees.

## Assessment

- 5.4 Based on the experience of the Athens Games, we have forecast demand for 676 channels in the Olympic Park, 374 in the River Zone and 179 in the Central Zone. Adding 25% to allow for contingency – which we believe to be a reasonable approach – would see demand for 845 channels in the Olympic Park, 468 in the River Zone and 224 in the Central Zone.
- 5.5 Spectrum cannot be reused for land radio between the Olympic Park and the River Zone, but it can be reused between these locations and the Central Zone. This means we anticipate a need to supply some 1,000 channels in total. As channel widths for land mobile radio are 12.5 kHz, this amounts to 12.5 MHz of spectrum.

## Proposals

- 5.6 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.

## LOCOG network

- 5.7 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, with one major RHB using BOCOG's land-radio network. It is very spectrally

efficient and avoids problems of incompatibility between users' equipment and available spectrum.

- 5.8 Given the reduction in our forecast demand for land-radio channels that would be achieved if members of the Olympic Family used LOCOG's network, we believe this to be a highly desirable option.

Licensed channels

- 5.9 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;
- 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 business-as-usual land-radio use; and
- for all of these reasons, there would be a greater risk of harmful interference.

- 5.10 However, if there are good reasons to license channels to guaranteed users with their own equipment, we could make the bands set out in table 2 below available.

**Table 2. Bands available for land radio and handheld communications (MHz)**

68.08125-87.49375	137-173	193.2-207.5 <sup>38</sup>	430-440 <sup>39</sup>	450-470
470-478	494-502	870-872 <sup>39</sup>	915-917 <sup>39</sup>	

- 5.11 We would prefer 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 430-478 MHz. At past Games, radio-amateur bands – especially 430-440 MHz – have been used.

- 5.12 Many guaranteed users with their own systems will want channels in both the Olympic Park and the River Zone. Use of CTCSS tones/DCS codes would allow the same channel to be used in both locations without harmful interference, reducing demand by a half. Currently, for each frequency assignment made, a minimum of one CTCSS tone and one DCS code is assigned if available in the requested area. We do this using a technical tool to check which tones/codes are not being used by other licensed systems in the surrounding geographic area. Applicants may seek more than one CTCSS tone and/or DCS code, and these will be assigned if available in the requested area.

<sup>38</sup> Also suitable for wireless microphones.

<sup>39</sup> Subject to coordination with MOD.

5.13 Table 3 below lists the available CTCSS tones.

**Table 3. Available CTCSS tones**

Primary set reference	Secondary set reference	Tone	Frequency (MHz)	Primary set reference	Secondary set reference	Tone	Frequency (MHz)
A	A1	1	67	A	A4	22	141.3
C	C1	2	69.3	B	B1	23	146.2
B	B1	3	71.9	A	A1	24	151.4
C	C2	4	74.4	B	B2	25	156.7
A	A2	5	77	A	A2	26	162.2
C	C3	6	79.7	B	B3	27	167.9
B	B2	7	82.5	A	A3	28	173.8
C	C3	8	85.4	B	B4	29	179.9
A	A3	9	88.5	A	A4	30	186.2
C	C1	10	91.5	B	B1	31	192.8
B	B3	11	94.8	C	C1	32	198
C	C2	12	97.4	A	A1	33	203.5
B	B4	13	103.5	C	C2	34	206.5
A	A4	14	107.2	B	B2	35	210.7
B	B1	15	110.9	A	A2	36	218.1
A	A1	16	114.8	B	B3	37	225.7
B	B2	17	118.8	C	C1	38	229.1
A	A2	18	123	A	A3	39	233.6
B	B3	19	127.3	B	B4	40	241.8
A	A3	20	131.8	A	A4	41	250.3
B	B4	21	136.5	C	C2	42	254.1

5.14 Table 4 below lists the available DCS codes.

**Table 4. Available DCS codes**

DCS group	Code	DCS group	Code	DCS group	Code
A	23	D	143	H	261
A	43	D	252	H	325
A	114	E	71	H	331
A	115	E	72	H	332
A	212	E	145	I	32
B	25	E	155	I	343
B	53	E	255	I	346
B	122	F	73	I	371
B	125	F	74	I	432
B	243	F	156	I	466
C	26	F	162	J	36
C	54	F	266	J	431
C	131	G	116	J	565
C	132	G	165	J	606
C	246	G	205	J	624
D	31	G	311	J	654
D	65	G	315		
D	134	H	226		

Licence-exempt equipment

5.15 PMR 446 equipment – also called family radio service – can use eight 12.5 kHz simplex channels anywhere in the UK on a licence-exempt basis. The channel centre frequencies are set out in table 5 below.

**Table 5. Centre frequencies for PMR446 channels (MHz)**

446.00625	446.01875	446.03125	446.04375
446.05625	446.06875	446.08125	446.09375

5.16 The 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 IR 2009<sup>40</sup> if placed on the market after this date.

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

5.18 As with all licence-exempt equipment, 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 Games. Problems may be reduced by changing channel or by using CTCSS tones/DCS codes.

5.19 DMR (Digital Mobile Radio) equipment is also now available and delivers two channels in 12.5 kHz bandwidth.

Third-party network

5.20 Land-radio networks are provided commercially in the UK.

Other means of communication

5.21 It may be possible for some PMR requirements to be met through other means of communication, particularly mobile telephones.

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

*Question 11. If not, how would you prefer to receive 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?*

<sup>40</sup> [www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/IR2009.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/IR2009.pdf).

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

## **Maritime radio**

- 5.22 Maritime radio may be used to support the sailing events at Weymouth Bay/Portland Harbour. Maritime channels are coordinated internationally.

### **Assessment**

- 5.23 A maritime subgroup of SPGOG met in 2008 to estimate demand for LOCOG and non-guaranteed public services. Its membership was drawn from 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 and Weymouth & Portland Borough Council. The need to liaise with such organisations was highlighted in responses to our discussion document.
- 5.24 The 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.
- 5.25 This estimate may reduce if LOCOG is able to guarantee performance of the Airwave land-radio network in Weymouth Bay/Portland Harbour.

### **Proposals**

- 5.26 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 ANFR.
- 5.27 We nonetheless wish to minimise the supply of maritime channels for the London Games:
- to avoid the need for further coordination with France; and
  - to avoid having to impose restrictions on business-as-usual use of this spectrum, which may become scarce between now and the Games.

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

## Section 6

# Audio links

## Introduction

6.1 This section sets out our assessment and proposals for spectrum for audio links – wireless microphones, IEMs, talkback and ADS.

## Wireless microphones and IEMs

6.2 Wireless microphones are mainly used by broadcasters or events organisers to capture interviews, music or sounds. They can be handheld or body worn, with integrated or body-worn transmitters. They are still predominantly analogue, although digital wireless microphones have improved to the extent that they are now being used in professional theatrical productions.

6.3 IEMs are mainly used by broadcasters or event participants to listen to their own voice or mixed feedback.

6.4 We expect to need to accommodate most, if not all, wireless microphones and IEMs in UHF Bands IV and V. For this reason, we have considered them alongside each other.

## Assessment

6.5 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 RHBs during these events.

6.6 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.

## Proposals

6.7 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 currently expected to be as set out in table 6 below.

**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	69	69	

	Available
	Available if held back from new use
	Not available – proposed for land radio/talkback
	Not available – awarded for new use
	Not available – used for DTT

- 6.8 This means that some 40 channels – each of 8 MHz, so totalling up to 320 MHz – could be available, particularly if we hold back rights of new use of the spectrum that will comprise the UK’s digital dividend until after digital switchover (DSO). It should be noted that this assessment is based on a number of assumptions about those processes, including the implementation of proposals on which we have yet to make final decisions and the outcome of negotiations with neighbouring countries to coordinate future use of UHF Bands IV and V.
- 6.9 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.
- 6.10 Accommodating a peak of 350 wireless microphones and 100 IEMs at the Olympic Park would require an average of 11 to be supported in each available channel. This already compares well with reference in ERC Report 42 to 12 microphones using a channel without separation between users, where distances as low as 3-6 metres could significantly improve efficiency of spectrum use. We understand that 16 microphones per channel are routinely realised by some UK users, while a maximum of 23 microphones per channel was achieved during the London stages of the 2007 Tour de France.
- 6.11 Moreover, we believe it may be possible to interleave wireless microphones and IEMs in the same channel without harmful interference between the two systems if they are deployed by different users.
- 6.12 We will carry out practical measurements to gain a better understanding of the limits to efficient use of UHF Bands IV and V by wireless microphones and IEMs, particularly given the proximity of broadcasters to each other in venues.
- 6.13 We propose to 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>41</sup>	1785-1800 <sup>42</sup>
-------------	---------	-----------------------	-------------------------

<sup>41</sup> On a licence-exempt basis.

<sup>42</sup> Digital wireless microphones only.

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

## Talkback

- 6.14 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.

## Assessment

- 6.15 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.

## Proposals

- 6.16 Talkback uses PMR-like technology and tends to operate in similar spectrum. We therefore propose to make the bands set out in table 8 below available for talkback.

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

430-440 <sup>43</sup>	450-470	470-478	494-502
-----------------------	---------	---------	---------

- 6.17 In particular, we propose to provide duplex channels in 460-468 MHz paired with 470-478 MHz.
- 6.18 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 could 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.

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

## ADS

- 6.19 ADS retransmit material already prepared for public use. They cover events and other temporary purposes.
- 6.20 LOCOG is considering using ADS to provide commentary at selected venues to enhance the spectator environment. A similar service is planned for the Vancouver Games. We will consider the spectrum requirement when LOCOG's own plans are clearer.
- 6.21 The band available for ADS is 60.75-62.75 MHz.

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

<sup>43</sup> Subject to coordination with MOD.

## Section 7

# Video links

## Introduction

7.1 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

7.2 Wireless-camera use is directly linked to broadcasting requirements. With perhaps 200 RHBs active at the London 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.

## Assessment

7.3 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) have taken advantage of developments in technology.

7.4 For the purposes of this consultation document, we have not allowed 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.

7.5 We have also planned 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. This, too, is overly generous as we anticipate we can 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) in practice. This approach would be particularly valuable for bands where demand at the London Games exceeds supply.

## Airborne use

7.6 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. Their altitude means opportunities for spectrum reuse are greatly diminished, while the range of usable spectrum is itself limited because of the mobility of these links and difficulties in obtaining line of sight. The radiated power required for the uplink (from a car/motorcycle to a helicopter/aeroplane) is also much higher as the required link can be obstructed by terrain and/or clutter and the transmitter and receiver may not always be in the same alignment (i.e. at the vertical of the ground vehicle).

7.7 Because of these factors, 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. This excludes many of the bands identified in our sharing studies (e.g. with radars) because they are predicated on low-power, in-venue use.

7.8 Based on the experience of the Beijing Games, we have forecast demand for three airborne wireless-channels in simultaneous use.

## Proposals

7.9 Several considerations underpin our proposals for wireless cameras:

- we expect OBS and RHBs to use wired rather than wireless cameras wherever practicable because of the greater quality and reliability that they afford;
- we believe we should identify more spectrum than our (already conservative) forecast 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). In particular, we have identified EHF spectrum that is not currently widely used by broadcasters but may become of value to some RHBs in the run-up to the London Games;
- not all channels within available bands will offer comparable utility, but their use in certain circumstances should not be discounted at this early stage of spectrum planning for the 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 1.3 GHz and 7.5 GHz; and
- only spectrum at 1-4 GHz can be made available for airborne. Below this band, it is difficult to secure sufficient bandwidth and equipment is not readily available. Above this band, signal alignment and propagation characteristics are not favourable.

7.10 In the light of these considerations, we propose to make 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 Games. These estimates are likely to change at the margin as we receive new information, not least in response to this consultation document.

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

Band (MHz)	Possible channel availability	Notes
1300-1320	2	Subject to compatibility with aeronautic/maritime radar
1660-1670	1	
2025-2110	7	Airborne use allowed
2200-2300	9	
2483-2500	1	

Band (MHz)	Possible channel availability	Notes
2700-2720	2	Subject to compatibility with aeronautic/ maritime/meteorological radar
2742-2772	3	
2820-2850	3	
2870-2890	2	
2900-3100	14	
3100-3400	Up to 21	Subject to compatibility with military radar
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

7.11 At this stage, we believe 137 channels – fulfilling 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. A full assessment of channel availability is outside the scope of this consultation document. We will turn to this in the light of consultation responses, more detailed information about the operating environment for wireless cameras in these bands and empirical tests of receivers likely to be used.

7.12 Based on the current competition schedule, these channels would also suffice for airborne use. It would be significantly more difficult to accommodate multiple simultaneous wide-area events without taking further steps, for example:

- clearing more channels for airborne use, particularly at 3.1-3.4 GHz;
- deploying a London-wide cellular receive system; or
- using alternative solutions.<sup>44</sup>

7.13 Nonetheless, if our proposals are broadly sufficient:

- 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;
- we do not believe it necessary to make available spectrum at 3400-3600 MHz that MOD plans to release for new use before the London Games (even though this would be desirable because much of the spectrum is currently available for airborne use);

<sup>44</sup> See, for example, [www.skylink.aero](http://www.skylink.aero).

- we do not believe it necessary to rely on spectrum at 2.4 GHz and 5 GHz available for licence-exempt use by WLANs (see section 8), though it could be used if desired;
- we do not believe it necessary to rely on EHF spectrum at 5-10 GHz, though it could be used if desired; and
- we do not believe it necessary to rely on SHF spectrum, though this, too, could be used if desired.

- 7.14 If it proves necessary to make 20 MHz channels available, we will create these from two adjacent 10 MHz channels. Since doing so could significantly reduce the number of wireless cameras that could use high-demand bands, our preference is to look first at the 5-10 GHz bands where we believe congestion is much less likely.

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

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

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

### **Point-to-point links**

- 7.15 Point-to-point links might be required to connect venues or to provide video signals to an 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.

### **Assessment**

- 7.16 We nonetheless foresee a requirement for point-to-point links for the London 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 Bay/Portland Harbour. And they have a role to play where it is impractical or prohibitively expensive to deploy fibre.
- 7.17 A specific forecast would not be helpful for spectrum-planning purposes this far ahead of the London Games, not least because of the variation in required bandwidth and the scope for frequency reuse as a result of using highly directional antennas.

### **Proposals**

- 7.18 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 business-as-usual basis.
- 7.19 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 business-as-usual basis, normal coordination procedures would apply.) If so, our preference would be to look first at the 5-10 GHz bands where we believe congestion is much less likely.

7.20 We therefore propose to 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 (MHz)**

5725-5850	7425-7900	10300-10360	10600-10680	12750-13250
14500-15350	17700-18456.25	18462.5-18700	18700-19466.25	19470.5-19700
22000-23600	24250-26500	31000-31300	31500-31800	37000-39500
51400-52600	55780-59000	64000-66000	71125-75825	81125-85875

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

7.22 It may also be possible to reduce the requirement for point-to-point links by using alternative solutions (e.g. free-space optics).

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

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

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

## Section 8

# Other guaranteed services

### Introduction

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

### Satellite services

8.2 Satellite services may be fixed or mobile. Satellites may also provide radionavigation (i.e. position-fixing) services.

### Fixed satellite services

8.3 Fixed satellite services (FSS) use earth stations operating at known locations that transmit to and/or receive from satellites. At the London 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

8.4 PES communicate to/from a known location with a satellite located in a geostationary orbit.

### *Assessment*

8.5 We expect there may be demand for a limited number of short-term licences for PES at some venues, including the IBC and Weymouth Bay/Portland Harbour.

### *Proposals*

8.6 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. 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 (12750-13250 MHz); limited sharing 10700-11700 MHz
	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	

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

### TES

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

### *Assessment*

8.9 We expect demand for TES to be high at Games venues. There will be some geographic restrictions on their use in close proximity to airports and other sensitive sites.

### *Proposals*

8.10 We expect the spectrum requirements generated by TES to be met on a business-as-usual basis. Spectrum access is mainly via commercial agreements with satellite operators, and availability is primarily dictated by the capacity on each satellite.

8.11 Authorisations are available in the bands shown in table 12 below.

**Table 12. Bands available for TES**

Band	Transmit frequencies (MHz)	Receive frequencies (MHz)	Notes
Ku	13780-14500	10700-12750	Shared with radio location services (13780-14000 MHz) and fixed services (14250-14500 MHz)

8.12 As TES share spectrum with other services, clearance and authorisation are required from us for each and every use prior to making any transmissions. As terminals are deployed at very short notice to any location, they require equally rapid clearance procedures. We therefore provide online clearance and authorisation for licensed TES terminals on our website using a tool called SPECTRAsc. This assesses the interference risk of clearance requests with regard to terrestrial fixed links, aircraft navigation systems and sensitive sites and then indicates the outcome both online and by email.

8.13 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 Games venues.

- 8.14 Some TES use of C-Band may be possible at “planned” locations, with known fixed transmission requirements. Such applications will be managed through business-as-usual PES processes.

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

### Mobile satellite services

- 8.15 Mobile satellite services (MSS) operate globally through a number of geostationary and non-geostationary satellite constellations, normally at 1-3 GHz. 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>45</sup>

#### Assessment

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

#### Proposals

- 8.17 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		Two operators as probable candidates	Primary MSS

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

<sup>45</sup> [www.cabinetoffice.gov.uk/ukresilience/preparedness/resilient\\_telecommunications/enhancing\\_catalogue.aspx](http://www.cabinetoffice.gov.uk/ukresilience/preparedness/resilient_telecommunications/enhancing_catalogue.aspx).

## Radionavigation satellite services

8.18 Radionavigation satellite services (RNSS) – commonly known as “sat nav” – provide signals for security, business and consumer devices. GPS, Glonass and Galileo 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.

### Assessment

8.19 RNSS will be widely used at the London Games at all venues.

### Proposals

8.20 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

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

## Telemetry and telecommand

8.21 Telemetry is the use of radiocommunications to automatically indicate or record measurements at a distance. Telecommand is the use of radiocommunications to initiate, modify or terminate equipment functions at a distance.

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

### **Assessment**

8.23 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 Bay/Portland Harbour and 20 channels distributed across other venues. This is greater than at the Athens Games.

### **Proposals**

8.24 Spectrum is available on a licence-exempt basis, so no arrangements will be required for most applications. Some of the available bands are set out in table 15 below.

**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

8.25 More applications are addressed in IR 2030.<sup>46</sup>

8.26 Although Bluetooth devices operating at 2.4 GHz are increasingly being used, the possibility of harmful interference from WLANs (see below) and even microwave ovens means they may not be suitable for critical services. Spectrum at 430-470 MHz proposed for land radio and/or talkback (see sections 5 and 6) may be better suited instead, although no requirements have yet been identified to us.

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

## WLANs

8.27 WLANs are also known as Wi-Fi and hot spots.

## Assessment

8.28 WLANs will be provided by LOCOG for the press and media, although it and its partners will be designing venues to maximise wired connectivity.

## Proposals

8.29 Spectrum is available on a licence-exempt basis. 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>47</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>48</sup>
5470-5725	1 W mean EIRP 50 mW/MHz mean EIRP density in any 1 MHz band – TPC and DFS implemented	

8.30 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,

<sup>46</sup> [www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/IR2030final.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/IR2030final.pdf).

<sup>47</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>48</sup> [www.ofcom.org.uk/radiocomms/ifi/tech/interface\\_req/uk2006.pdf](http://www.ofcom.org.uk/radiocomms/ifi/tech/interface_req/uk2006.pdf).

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 5 GHz band and the 802.11a networking standard. They will not be able to use the 2.4 GHz band (802.11 b/g/n) or selected channels at 5 GHz (802.11 a/n). VANOC will stipulate the SIDH and channel assignment.

- 8.31 LOCOG has not made any similar decisions about the London Games, but controlling use of the 2.4 GHz and 5 GHz bands could help to reduce congestion for WLANs and harmful interference to other services. We would welcome comments on this.

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

## Section 9

# Football venues

### Introduction

9.1 This section sets out our assessment and proposals for spectrum at 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.

### Assessment

9.2 We have examined the requirements for spectrum at past Games and comparable events, notably the Athens and Beijing Games, the 1998 FIFA World Cup and the 2008 UEFA European Football Championship. We also note that Wembley will host the final of the 2011 Champions League.

9.3 We believe the spectrum requirements of the London Games will be no greater than business as usual at other high-profile football matches and broadly consistent across all six venues. Specifically, we forecast spectrum use at the 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
- two channels for wireless cameras (possibly only for the final at Wembley).

### Proposals

9.4 In the light of our assessment, we believe the spectrum requirements at the six football venues are addressed by our proposals in sections 5 to 8. It should be noted that the five venues outside London are not affected by other Games requirements and therefore spectrum normally available for PMSE in the UK should suffice. We will nonetheless review our assessment and the implications for spectrum availability in the light of future arrangements between LOCOG and the venue operators.

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

## Section 10

# Cultural events

### Introduction

- 10.1 This section sets out our assessment and proposals for spectrum for cultural events – the torch relays, the Opening and Closing Ceremonies, team-welcome ceremonies, medal/victory ceremonies and other events and celebrations.

### Mandatory ceremonies

- 10.2 The mandatory ceremonies fall within the scope of the Government's spectrum guarantees.

### Olympic and Paralympic torch relays

- 10.3 The torch relay is an important part of the build-up to the London Games. Celebrating and uniting sport and culture, it will bring the spirit of the Games to the whole of the UK in the months in 2012 leading up to the Opening Ceremony.
- 10.4 Lit in Olympia and carried by torch bearers selected through various processes including a ballot, the Olympic Flame will pass through communities, with entertainment, shows and concerts marking its arrival. There will also be educational programmes for young people and the chance to take part as a volunteer.
- 10.5 The build-up to the Paralympic Games will also be marked by a UK-wide Paralympic torch relay in August 2012. Celebrations and events will feature as part of the period leading up to the Opening Ceremony of the Paralympic Games on 29 August 2012.
- 10.6 The route for the Olympic torch relay will be announced in 2011. Announcements regarding the route of the Paralympic torch relay are likely to be made in early 2012.
- 10.7 While the torch relays fall within the scope of the Government's spectrum guarantees, we expect the spectrum requirements generated by the torch relays will not exceed the availability of spectrum used on a business-as-usual basis. Where that spectrum is not available on a UK-wide basis, we will endeavour to minimise the operational implications.

### Olympic and Paralympic Opening and Closing Ceremonies

- 10.8 The Opening and Closing Ceremonies of the Games are watched by a worldwide audience of one in three people. They will welcome the world to London and set the tone for the 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 Games through Live Sites in their cities, regions and nations.
- 10.9 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 in sections 5 to 8.

## **Team-welcome ceremonies**

- 10.10 Each Olympic and Paralympic team will be welcomed to London as they arrive at the Olympic Village. There will be 205 teams competing at the Games, but up to five nations might be welcomed in each ceremony.
- 10.11 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.
- 10.12 The spectrum requirements generated by the team-welcome ceremonies are addressed by our proposals in section 5 to 8.

## **Medal/victory ceremonies**

- 10.13 During victory ceremonies across the Olympic 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.
- 10.14 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.
- 10.15 The spectrum requirements generated by the medal/victory ceremonies are addressed by our proposals in section 5 to 8.

## **Other events and celebrations**

- 10.16 These 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 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-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 2012. 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 in 2012 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 Olympic or Paralympic 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 brand family and recognises that a project has been “inspired by London 2012” and reflects the values of the Olympic and Paralympic Movements.

- 10.17 Other events and celebrations do not fall within the scope of the Government’s spectrum guarantees. We expect the spectrum requirements they generate to be met on a business-as-usual basis. 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.

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

## Section 11

# Non-guaranteed services

## Introduction

11.1 As set out in section 2, we have agreed with the Government that its spectrum guarantees do not apply to many services that will nonetheless require spectrum for the London 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

11.2 Non-guaranteed public services primarily support the organisation of the London Games and/or have a presence at venues. They include:

- military services;
- E&PSS;
- security;
- public transport;
- construction;
- catering;
- maritime services;
- healthcare; and
- other third-party contractors.

11.3 The Public Safety Spectrum Policy Group (PSSPG) is responsible for considering the spectrum requirements at the London Games of the services within its remit. PSSPG is, like SPGOG, a subcommittee of UKSSC. It comprises representatives from Ofcom, BERR, the Home Office, the Scottish Government, the Department for Communities and Local Government and the Department of Health. MOD participates as required. PSSPG is chaired independently, and its technical subgroup manages day-to-day assignments of spectrum for E&PSS.

11.4 The Independent Audit of Spectrum Holdings set out a framework for improving spectrum management in the public sector.<sup>49</sup> The Government's response stated that:<sup>50</sup>

2.3 Where public bodies have significant requirements for additional spectrum, there will be a presumption that these needs will be met through the market. There may be certain exceptional cases, as identified by the Audit, where it will be necessary for an administrative assignment to be made. The

<sup>49</sup> [www.spectrumbaudit.org.uk/pdf/caveaudit.pdf](http://www.spectrumbaudit.org.uk/pdf/caveaudit.pdf).

<sup>50</sup> [www.bandsharing-forum.org.uk/documents/governmentresponsetocaveaudit.pdf](http://www.bandsharing-forum.org.uk/documents/governmentresponsetocaveaudit.pdf).

Government expects to minimise the need for such regulatory intervention through effective forward planning. Minor assignments, where there is no potential for distortion, will continue to be made on a first-come first-served basis, subject to agreement by the relevant sub-group of UKSSC.

- 2.4 If requirements cannot reasonably be satisfied through existing national allocations or through the market, and there is a demonstrated safety or security critical need, or mandatory international obligation, a non-market assignment will be considered through UKSSC. If it is agreed by the UKSSC that an exception is justified, consideration will be given to formally directing Ofcom, under the appropriate provisions of the Communications Act 2003, to make the spectrum available through administrative assignment.
- 2.5 The public body or bodies responsible for generating the requirement will meet any costs incurred in making spectrum available through non-market assignment.
- 11.5 We envisage that non-guaranteed public services with spectrum requirements generated by the unique nature of the London Games will follow this process of satisfying them through existing national allocations or the market, with Government direction and administrative assignment only if an exception is 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.

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

### **Private services**

- 11.6 Non-guaranteed private services primarily improve the experience of the London Games – some significantly so – but are not directed by LOCOG or others directly responsible for the organisation of the Games. Any spectrum requirements generated by the unique nature of the London Games will have to be met through the market and existing assignment processes. We do not propose seeking to ensure that any such requirements can be met or are coordinated with the requirements for guaranteed services.
- 11.7 Non-guaranteed private services include the following.

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

- 11.8 Non-rights-holding broadcasters will not have access to coverage of the London Games from within venues, although they will be able to cover news stories outside venues. Visit London will play an important role in helping to meet their needs.

### **Public mobile communications**

- 11.9 The five UK mobile-network operators (MNOs) and ODA have been discussing public mobile communications coverage in 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.
- 11.10 LOCOG will lead on the coordination, planning and provision of any temporary radio-distribution infrastructure required within venues for public mobile communications

coverage as well as for E&PSS and its own operational requirements. ODA will continue to lead on any issues relating to the planning authorities, namely external infrastructure for the Olympic Park.

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

- 11.11 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). They could be used for a radio station dedicated to a specific (e.g. sporting or cultural) aspect of the London Games.
- 11.12 We will base our approach to requests for S-RSLs during the Games on our normal policy, noting that spectrum for such services is invariably in short supply in London.

### **Wireless CATV**

- 11.13 This is an OBS project, still in the pilot phase, looking 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.
- 11.14 If deployed at the London 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 the Vancouver Games, would probably focus on those with greatest spectator demand.
- 11.15 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.

*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?*

## Section 12

# Innovation and legacy

## Introduction

- 12.1 This section sets out our role in supporting innovation at the London Games and delivering a legacy to London.

## Innovation

- 12.2 LOCOG's telecoms services will be provided on a mature, proven and reliable technology base, which is vital for the smooth operation of the Games. There may be some opportunity for LOCOG partners to showcase innovative communications solutions, but the main operation of the London Games will not be based on these services.
- 12.3 We do not have a direct role in promoting innovation at the London 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

- 12.4 After the London 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.
- 12.5 We have agreed with the Government that its spectrum guarantees do not extend beyond the end of the London Games and so do not cover legacy. Spectrum temporarily made available by UK public-sector bodies will be returned to them once the Games requirement has ended, and any new spectrum will need to be secured through existing allocation and assignment processes or through the market. We will be happy to provide advice in this regard to the Olympic Legacy Company now being established.

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

## Section 13

# Operational issues

### Introduction

- 13.1 We have worked closely with EETT, ACMA and ANFR 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.
- 13.2 This section sets out proposed high-level approaches to licensing/authorisation and interference management for the London Games drawing on these experiences.

### Licensing/authorisation

- 13.3 As previously noted, the London 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 Games and the unique challenge it presents for interference management make it necessary to establish special licensing arrangements.
- 13.4 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.

*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?*

### Application method

- 13.5 At recent Games, it has been possible for guaranteed users 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. We are currently discussing with LOCOG the best way to receive requests for spectrum from guaranteed users but are likely 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.
- 13.6 We would plan to start accepting applications for licences in early 2011, around 18 months prior to the London Games. 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.

*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?*

- 13.7 Non-guaranteed users seeking spectrum will have to do so through the market and our existing assignment processes.

## Nature of authorisation

- 13.8 In processing licence applications, we intend to conduct detailed technical analyses to ensure compatibility between different uses of spectrum. The licences we intend to grant typically specify the location, frequency, bandwidth, modulation and power of permitted operation. Where demand for spectrum is particularly high, it may also be necessary to authorise some uses only at specific venues and at specific times.
- 13.9 In the run-up to the London Games, we intend to work closely with LOCOG and, through it, with other key stakeholders to better understand demand for spectrum and ensure opportunities for sharing and coordination between users are fully exploited.

## Coordination with non-Games use

- 13.10 Some of the spectrum identified in this draft spectrum plan will be shared with non-Games users. In the run-up to and during the London Games, it may be necessary to coordinate some of this use with the requirements of the Games. In performing this task, we will seek to strike an appropriate balance between ensuring the success of the Games and minimising their impact on other spectrum users. We are currently examining a number of 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 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 Games and non-Games use; and
  - establishing geographic exclusion zones around Games venues where any spectrum use will require specific additional authorisation from us.
- 13.11 In certain circumstances, it might be necessary to revoke or temporarily vary licences to allow spectrum use for the London Games. We believe such circumstances are likely to be very rare, and we would endeavour to explore all options to accommodate both Games and non-Games use prior to taking such action.
- 13.12 We are currently examining how best to ensure efficient coordination between shared Games and non-Games use of the same spectrum. It is likely that arrangements will vary by band and by service. We will make more details known in due course.

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

## Licence-exempt equipment

- 13.13 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.
- 13.14 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 Games. Practical measures (e.g. preventing certain types of equipment from being brought

into Games venues or actively coordinating use between users) have proved successful at past Games.

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

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

## Interference management

- 13.15 We expect the London Games to place unprecedented pressure on the use of spectrum within the capital. Our Field Operations teams will help to ensure the 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.
- 13.16 As part of our response, we will consider providing a validation service for wireless transmitter equipment that will be used within key 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 Games venues.
- 13.17 Before the London Games, we will ensure the spectrum they require is as free from unauthorised use and unwanted emissions as is reasonably practicable. During the 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
  - ↓ business as usual
- 13.18 We will consider deploying dedicated interference-resolution teams within key Games venues to reduce our response times as far as reasonably practicable.
- 13.19 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 39. How can interference management be most effective in ensuring the successful running of the London Games? Are there other measures we should consider implementing? To what extent is your response based on previous experience of similar events?*

## Section 14

# Test events

## Introduction

- 14.1 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 Games. The full test-event schedule will be available by December 2009.
- 14.2 The Government has advised us that it regards its spectrum guarantees to include test events organised and led by LOCOG.

## Relevance for spectrum management

### Spectrum plan

- 14.3 We do not believe that the test events will be relevant to the spectrum plan for the London Games for four main reasons:
- the spectrum we are proposing to make 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 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 discussion document.
- 14.4 Nonetheless, as noted in section 3, we are monitoring spectrum use at a number of locations, and this will enable us to be as sure as we can that the spectrum we make available will be free from harmful interference during the London Games.
- 14.5 Stakeholders expecting to use new equipment during the 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 grant nonoperational licences for this purpose.<sup>51</sup>

## Licensing

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

---

<sup>51</sup> [www.ofcom.org.uk/radiocomms/ifi/licensing/classes/nonoperational/](http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/nonoperational/).

- 14.7 We will endeavour to cause minimum disruption to those using spectrum on a business-as-usual 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**

- 14.8 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 Games.

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

## Section 15

# Next steps

- 15.1 We invite responses to the questions raised in this consultation document by 5 August 2009. See annex 1 for details of how to respond.
- 15.2 We will be happy to discuss our proposals in detail during the consultation period with stakeholders – especially those unfamiliar with the regulatory environment for wireless services in the UK – who would find this helpful.
- 15.3 We intend to publish a statement on the spectrum plan for the London Games by the end of 2009. We anticipate it will be subject to ongoing refinement in the run-up to the Games themselves. It is therefore important to note that the spectrum plan and broader spectrum policy in the UK are subject to change between now and the Games. We will seek to keep any changes to a minimum.
- 15.4 Following the London Games, we will need to address the spectrum requirements of the Glasgow 2014 Commonwealth Games. Our approach will be informed by the views that we form in the light of responses to this consultation document. We will consult separately on arrangements for the Glasgow Games in due course.

## Annex 1

# Responding to this consultation

## How to respond

- A1.1 We invite written views and comments on the issues raised in this document, to be made by 5 p.m. on 5 August 2009.
- A1.2 We strongly prefer to receive responses using the online web form at [www.ofcom.org.uk/consult/condocs/london2012/howtorespond/form](http://www.ofcom.org.uk/consult/condocs/london2012/howtorespond/form) as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see annex 3) to indicate whether or not there are confidentiality issues. This response cover sheet is incorporated into the online web-form questionnaire.
- A1.3 For larger consultation responses – particularly those with supporting charts, tables or other data – please email [olympics.spectrum@ofcom.org.uk](mailto:olympics.spectrum@ofcom.org.uk), attaching your response in Microsoft Word format, together with a consultation-response cover sheet.
- A1.4 Responses may alternatively be posted to the address below, marked with the title of the consultation.
- Steve Jones  
Ofcom  
Riverside House  
2a Southwark Bridge Road  
London SE1 9HA  
United Kingdom
- A1.5 Note that we do not need a hard copy in addition to an electronic version. We will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.
- A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together in annex 3. It would also help if you can explain why you hold your views and how our proposals would impact on you.

## Further information

- A1.7 If you want to discuss the issues and questions raised in this consultation or need advice on the appropriate form of response, please contact Steve Jones on +44 (0)20 7783 4524.

## Confidentiality

- A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, [www.ofcom.org.uk](http://www.ofcom.org.uk), ideally on receipt. If you think your response should be kept confidential, please specify what part and why. Please also place such parts in a separate annex.

- A1.9 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and try to respect it. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.
- A1.10 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to us to use. Our approach on intellectual property rights is explained further on our website at [www.ofcom.org.uk/about/accoun/disclaimer](http://www.ofcom.org.uk/about/accoun/disclaimer).

### Next steps

- A1.11 Following the end of the consultation period, we intend to publish a statement by the end of 2009 with our views at that time on the spectrum plan for the London Games. This will then be subject to ongoing refinement in the run-up to the Games themselves.
- A1.12 Please note that you can register to receive free mail updates alerting you to the publications of relevant Ofcom documents. For more details, please see [www.ofcom.org.uk/static/subscribe/select\\_list.htm](http://www.ofcom.org.uk/static/subscribe/select_list.htm).

### Our consultation processes

- A1.13 We seek to ensure that responding to a consultation is as easy as possible. For more information, please see our consultation principles in annex 2.
- A1.14 If you have any comments or suggestions on how we conducts our consultations, please call our consultation helpdesk on +44 (0)20 7981 3003 or email us at [consult@ofcom.org.uk](mailto:consult@ofcom.org.uk). We would particularly welcome thoughts on how we could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.
- A1.15 If you would like to discuss these issues or our consultation processes more generally, you can alternatively contact Vicki Nash, Director Scotland, who is our consultation champion:

Vicki Nash  
Ofcom  
Sutherland House  
149 St. Vincent Street  
Glasgow G2 5NW  
United Kingdom

Tel: +44 (0)141 229 7401  
Fax: +44 (0)141 229 7433

Email [vicki.nash@ofcom.org.uk](mailto:vicki.nash@ofcom.org.uk)

## Annex 2

# Our consultation principles

A2.1 We have published the following seven principles that we will follow for each public written consultation.

### Before the consultation

A2.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

### During the consultation

A2.3 We will be clear about whom we are consulting, why, on what questions and for how long.

A2.4 We will make the consultation document as short and simple as possible. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened Plain English Guide for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will consult for up to 10 weeks depending on the potential impact of our proposals.

A2.6 A person within Ofcom will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. Our consultation champion will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why.

### After the consultation

A2.8 We think it is important for everyone interested in an issue to see the views of others during a consultation. We will usually publish all the responses we have received on our website. In our statement, we will give reasons for our decisions and will give an account of how the views of those concerned helped shape them.

## Annex 3

# Consultation-response cover sheet

- A3.1 In the interests of transparency and good regulatory practice, we will publish all consultation responses in full on our website: [www.ofcom.org.uk](http://www.ofcom.org.uk).
- A3.2 We have produced a cover sheet for responses (see below) and would be very grateful if you could send one with your response. (It is incorporated into the online web form if you respond in this way.) This will speed up our processing of responses and help to maintain confidentiality where appropriate.
- A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore, we would encourage respondents to complete their cover sheet in a way that allows us to publish their responses upon receipt rather than waiting until the consultation period has ended.
- A3.4 We strongly prefer to receive responses via the online web form, which incorporates the cover sheet. If you are responding via email, post or fax, you can download an electronic copy of this cover sheet in Word or RTF format from the consultations section of our website at [www.ofcom.org.uk/consult/](http://www.ofcom.org.uk/consult/).
- A3.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details or job title to remain confidential, please provide them in your cover sheet only so we do not have to edit your response.

**Cover sheet for response to an Ofcom consultation**

**BASIC DETAILS**

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

**CONFIDENTIALITY**

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing  Name/contact details/job title

Whole response  Organisation

Part of the response  If there is no separate annex, which parts?

If you want part of your response, your name or your organisation not to be published, can we still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

**DECLARATION**

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard email text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part) and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name

Signed (if hard copy)

## Annex 4

# Consultation questions

## Approach

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

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

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

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

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

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

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

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

## Assumptions and summary conclusions

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

## Private mobile radio

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

*Question 11. If not, how would you prefer to receive 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?*

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

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

## Audio links

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

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

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

## **Video links**

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

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

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

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

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

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

## **Other guaranteed services**

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

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

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

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

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

## **Football venues**

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

## **Cultural events**

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

## **Non-guaranteed services**

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

*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?*

## **Innovation and legacy**

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

## **Operational issues**

*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?*

*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?*

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

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

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

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

## **Test events**

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

## Annex 5

## Venues for the London Games

Venue	Events
Aquatics centre	<ul style="list-style-type: none"> <li>• Diving</li> <li>• Modern pentathlon (swimming)</li> <li>• Paralympic swimming</li> <li>• Swimming</li> <li>• Synchronised swimming</li> <li>• Water polo (finals)</li> </ul>
Basketball arena	<ul style="list-style-type: none"> <li>• Basketball (preliminaries)</li> <li>• Handball (finals)</li> <li>• Modern pentathlon (fencing and shooting)</li> <li>• Wheelchair basketball</li> <li>• Wheelchair rugby</li> </ul>
Broxbourne canoe slalom	<ul style="list-style-type: none"> <li>• Canoe/kayak slalom</li> </ul>
Earl's Court	<ul style="list-style-type: none"> <li>• Volleyball</li> </ul>
Eton Dorney	<ul style="list-style-type: none"> <li>• Canoe/kayak flatwater</li> <li>• Rowing</li> </ul>
Eton Manor	<ul style="list-style-type: none"> <li>• Paralympic archery</li> <li>• Paralympic wheelchair tennis</li> </ul>
ExCeL Exhibition Centre	<ul style="list-style-type: none"> <li>• Boxing</li> <li>• Fencing</li> <li>• Judo</li> <li>• Paralympic boccia</li> <li>• Paralympic fencing</li> <li>• Paralympic judo</li> <li>• Paralympic powerlifting</li> <li>• Paralympic table tennis</li> <li>• Table tennis</li> <li>• Taekwondo</li> <li>• Weightlifting</li> <li>• Wrestling</li> </ul>
Hadleigh Farm	<ul style="list-style-type: none"> <li>• Cycling (mountain biking)</li> </ul>
Hampden Park, Glasgow	<ul style="list-style-type: none"> <li>• Football</li> </ul>
Handball arena	<ul style="list-style-type: none"> <li>• Handball (preliminaries)</li> <li>• Paralympic goalball</li> </ul>
Hockey centre	<ul style="list-style-type: none"> <li>• Hockey</li> <li>• Paralympic five- and seven-a-side football</li> </ul>
Horse Guards Parade	<ul style="list-style-type: none"> <li>• Beach volleyball</li> </ul>
Hyde Park	<ul style="list-style-type: none"> <li>• Swimming</li> <li>• Triathlon</li> </ul>
Lord's Cricket Ground	<ul style="list-style-type: none"> <li>• Archery</li> </ul>
Maritime Greenwich	<ul style="list-style-type: none"> <li>• Equestrian</li> <li>• Modern pentathlon (riding and running)</li> <li>• Paralympic equestrian</li> </ul>
Millennium Stadium, Cardiff	<ul style="list-style-type: none"> <li>• Football</li> </ul>

Venue	Events
North Greenwich Arena 1	<ul style="list-style-type: none"> <li>• Basketball (finals)</li> <li>• Gymnastics (artistic and trampoline)</li> <li>• Wheelchair basketball</li> </ul>
North Greenwich Arena 2	<ul style="list-style-type: none"> <li>• Badminton</li> <li>• Gymnastics (rhythmic)</li> <li>• Paralympic volleyball (sitting)</li> </ul>
Old Trafford, Manchester	<ul style="list-style-type: none"> <li>• Football</li> </ul>
Olympic Stadium	<ul style="list-style-type: none"> <li>• Athletics</li> <li>• Marathon (finish)</li> <li>• Paralympic marathon</li> <li>• Paralympic track and field</li> <li>• Race walk (finish)</li> </ul>
Regent's Park	<ul style="list-style-type: none"> <li>• Cycling (road)</li> <li>• Paralympic cycling (road)</li> </ul>
Royal Artillery Barracks	<ul style="list-style-type: none"> <li>• Shooting</li> <li>• Paralympic shooting</li> </ul>
St. James's Park, Newcastle	<ul style="list-style-type: none"> <li>• Football</li> </ul>
Velo Park	<ul style="list-style-type: none"> <li>• BMX</li> <li>• Cycling (track)</li> <li>• Paralympic cycling (track)</li> </ul>
Villa Park, Birmingham	<ul style="list-style-type: none"> <li>• Football</li> </ul>
Water polo	<ul style="list-style-type: none"> <li>• Water polo</li> </ul>
Wembley Stadium	<ul style="list-style-type: none"> <li>• Football</li> </ul>
Weymouth Bay and Portland Harbour	<ul style="list-style-type: none"> <li>• Paralympic sailing</li> <li>• Sailing</li> </ul>
Wimbledon	<ul style="list-style-type: none"> <li>• Tennis</li> </ul>

## Annex 6

# SPGOG terms of reference and membership

- A6.1 The Spectrum Planning Group for the London 2012 Olympic Games and Paralympic Games (SPGOG) is a subcommittee of the Cabinet Official Committee on UK Spectrum Strategy (UKSSC) and is established in response to a decision reached by UKSSC in January 2007.
- A6.2 In a letter dated 26 October 2004 to the President of the International Olympic Committee, the Secretary of State for Trade and Industry guaranteed on behalf of the UK Government the allocation of the spectrum required for the organisation of the Games and the waiving of fees payable for the spectrum so allocated. SPGOG is required to support the Office of Communications (Ofcom) in meeting its responsibility to organise a full spectrum plan for the Games – addressing uses that fall both within and without the Government guarantees – and to arrange all the spectrum licences in good time in support of the plan.
- A6.3 Membership of SPGOG is open to representatives from:
- Ofcom;
  - the Cabinet Office;
  - the Civil Aviation Authority;
  - the Department for Business, Enterprise and Regulatory Reform;
  - the Department for Communities and Local Government;
  - the Department for Culture, Media and Sport;
  - the Department of Health
  - the Department for Transport;
  - Government Communications Headquarters;
  - the Greater London Authority;
  - HM Revenue and Customs;
  - HM Treasury;
  - the London Organising Committee of the Olympic Games and Paralympic Games;
  - the Maritime and Coastguard Agency;
  - the Ministry of Defence;

- the National Policing Improvement Agency;
- the Olympic Delivery Authority;
- the Olympic Security Directorate of the Metropolitan Police; and
- the Scottish Government

as well as other members of UKSSC not identified above.

- A6.4 Ofcom chairs SPGOG and provides the secretariat. Meetings will typically be held monthly. Where appropriate, work will be progressed in the intervening periods by email correspondence. Where necessary, SPGOG will seek advice from and work with others who it determines will assist in meeting its remit.
- A6.5 Members of SPGOG are free to escalate issues within its remit to other appropriate governance processes, notably the Olympic Board

## Annex 7

# Glossary of abbreviations

<b>ACMA</b>	Australian Communications and Media Authority
<b>ADS</b>	Audio distribution services
<b>AIP</b>	Administered incentive pricing
<b>ANFR</b>	Agence nationale des fréquences
<b>ASBU</b>	Arab States Broadcasting Union
<b>BERR</b>	Department for Business, Enterprise and Regulatory Reform
<b>CAA</b>	Civil Aviation Authority
<b>CCTV</b>	China Central Television
<b>CSR</b>	Coastal-station radio
<b>CTCSS</b>	Continuous Tone-Controlled Signalling System
<b>CTV</b>	CTV Television Network
<b>dB</b>	Decibel
<b>DCS</b>	Digitally Coded Squelch
<b>DFS</b>	Dynamic frequency selection
<b>DSO</b>	Digital switchover
<b>DVB-T</b>	Digital Video Broadcast – Terrestrial
<b>E&amp;PSS</b>	Emergency and public-safety services
<b>EBU</b>	European Broadcasting Union
<b>ECC</b>	Electronic Communications Committee
<b>EETT</b>	Hellenic Communications and Post Commission
<b>EHF</b>	Extremely High Frequency
<b>EIRP</b>	Effective isotropically radiated power
<b>ENG</b>	Electronic newsgathering
<b>ERC</b>	European Radiocommunications Committee
<b>ETSI</b>	European Telecommunications Standards Institute
<b>FA</b>	Football Association
<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>IP</b>	Internet Protocol
<b>IR</b>	Interface Requirement
<b>IRB</b>	International Rugby Board
<b>kHz</b>	Kilohertz

<b>LOCOG</b>	London Organising Committee of the Olympic Games and Paralympic Games
<b>LMS</b>	Link Modulation System
<b>MCA</b>	Maritime and Coastguard Agency
<b>MHz</b>	Megahertz
<b>MNO</b>	Mobile-network operator
<b>MOD</b>	Ministry of Defence
<b>MPC</b>	Main Press Centre
<b>MPEG</b>	Moving Picture Experts Group
<b>MSS</b>	Mobile satellite services
<b>mW</b>	Milliwatt
<b>NBC</b>	National Broadcasting Company
<b>NOC</b>	National Olympic committee
<b>OB</b>	Outside broadcasting
<b>OBS</b>	Olympic Broadcasting Services
<b>ODA</b>	Olympic Delivery Authority
<b>ORN</b>	Olympic Route Network
<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>R&amp;TTE</b>	Radio and Telecommunications Terminal Equipment
<b>SAB</b>	Services ancillary to broadcasting
<b>SAP</b>	Services ancillary to programme-making
<b>SBS</b>	Seoul Broadcasting System
<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>S-RSL</b>	Short-term restricted-service licence
<b>TES</b>	Transportable earth station
<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>WLAN</b>	Wireless local-area network