



Auction of spectrum:
10 GHz, 28 GHz, 32 GHz and
40 GHz
INFORMATION MEMORANDUM UPDATE

Publication date: 3 December 2007

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Section 1

Background

- 1.1 This document sets out changes made to the information contained in the Information Memorandum for the award of Wireless Telegraphy Act licences in the 10 GHz, 28 GHz, 32 GHz and 40 GHz bands.
- 1.2 On 7 August 2007 the Office of Communications ('Ofcom') published an Information Memorandum ('the Memorandum')¹ that provided information for those parties considering bidding for a licence under the Wireless Telegraphy Act 2006 to establish or use stations for wireless telegraphy or install or use apparatus for wireless telegraphy in one or more of the 10 GHz, 28 GHz, 32 GHz and 40 GHz bands ('the spectrum bands') in the United Kingdom.
- 1.3 In particular, the Memorandum:
 - described the characteristics of the spectrum bands for which Licences are to be awarded, and the way in which they will be packaged;
 - summarised the principal terms of the licences that will be issued following completion of the award process;
 - summarised the steps that persons need to take in order to qualify and take part in the award process;
 - summarised the rules and timetable for the award process; and
 - contained a draft Licence.
- 1.4 Since publication of the Memorandum a number of changes have been made to the information under each of these bullets. Section 2 of this document provides updated information. Annex 1 has a revised draft Licence. Annex 2 has a table that indicates where the numbering of particular regulations referred to in the Memorandum has changed.
- 1.5 The notice at the front of the Memorandum (headed "Important Notice") applies to this update as it applies to the Memorandum.

¹ http://www.ofcom.org.uk/radiocomms/spectrumawards/awardspending/award_10_40/10-40IM.pdf

Section 2

Updated information

2.1 Information in the following paragraphs of the Memorandum has been updated.

The Bands

Spectrum in the national and sub-national 28 GHz bands

Co-ordination of Fixed Satellite Service earth stations

2.2 In paragraph 2.16 we said that with respect to coordinated FSS earth stations, we had adapted our permanent earth station licensing procedures² so that applications might be made for access to the 27.5-29.5 GHz band. Earth stations licensed under this procedure would transmit in that part of the Band that is the subject of this award. Ofcom accepted applications made between 7 August and 2 November 2007. The table below gives details of the earth stations for which we have received applications. At the date of publication of this document we had not issued a licence in the award bands for any of the earth stations listed.

Table 1 – Details of satellite earth stations for which licence applications have been received

	NGR	Post Code	Azimuth	Elevation	Dish Size (m)	Performance Pattern	Gain dBi	Max Input Power Density (dBW/MHz)
1	SU4205134917	SO21 2QA	218.87	24.24	8.1	Rec 465	65.1	-3.9
2	SU4205934889	SO21 2QA	140.81	24.11	8.1	Rec 465	65.1	-3.9
3	SU4209534805	SO21 2QA	111.72	8.13	8.1	Rec 465	65.1	-3.9
4	SU5166629278	SO21 1HX	219.03	24.23	8.1	Rec 465	65.1	-3.9
5	SU5160829253	SO21 1HX	140.94	24.21	8.1	Rec 465	65.1	-3.9
6	SU5160829227	SO21 1HX	111.82	8.23	8.1	Rec 465	65.1	-3.9
7	TL0362861130	MK44 1SN	219.43	22.94	8.1	Rec 465	65.1	-3.9
8	TL0364161135	MK44 1SN	142.24	23.57	8.1	Rec 465	65.1	-3.9
9	TL0364461147	MK44 1SN	112.81	8.23	8.1	Rec 465	65.1	-3.9
10	SO4216637715	HR2 9NJ	216.94	24.05	8.1	Rec 465	65.1	-3.9
11	SO4217837704	HR2 9NJ	160.2	28.69	8.1	Rec 465	65.1	-3.9
12	SO4219137715	HR2 9NJ	139.62	22.76	8.1	Rec 465	65.1	-3.9
13	SO4217837704	HR2 9NJ	177.66	30.45	8.1	Rec 465	65.1	-3.9
14	SO4217837704	HR2 9NJ	110.74	6.96	8.1	Rec 465	65.1	-3.9
15	SW7198021560	TR12 6LQ	215.1	26.69	8.1	Rec 465	65.1	-3.9
16	SW7205621546	TR12 6LQ	156.8	30.07	8.1	Rec 465	65.1	-3.9
17	SW7201421519	TR12 6LQ	136	23	8.1	Rec 465	65.1	-3.9
18	SW7205621546	TR12 6LQ	108.28	6.24	8.1	Rec 465	65.1	-3.9
19	SW7205621546	TR12 6LQ	173.92	32.44	8.1	Rec 465	65.1	-3.9
20	SW3738925022	TR19 6NB	214.54	26.87	8.1	Rec 465	65.1	-3.9
21	SW3743525044	TR19 6NB	156.22	29.95	8.1	Rec 465	65.1	-3.9

² Ofcom's procedures for licensing permanent earth stations are at http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/satellite/procedure_manuals/PermanentEarthStation.pdf

22	SW3741225033	TR19 6NB	135.84	23.03	8.1	Rec 465	65.1	-3.9
23	SW3743525044	TR19 6NB	107.89	5.94	8.1	Rec 465	65.1	-3.9
24	SW3743525044	TR19 6NB	173.92	32.44	8.1	Rec 465	65.1	-3.9
25	SP4558573484	CV23 9EU	218.46	23.18	8.1	Rec 465	65.1	-3.9
26	SP4564273602	CV23 9EU	179.58	30.12	8.1	Rec 465	65.1	-3.9
27	SP4564273602	CV23 9EU	112.12	7.7	8.1	Rec 465	65.1	-3.9
28	SP4561673593	CV23 9EU	141.36	23.11	8.1	Rec 465	65.1	-3.9
29	SP4564273602	CV23 9EU	162.12	28.69	8.1	Rec 465	65.1	-3.9
30	SP5877462179	NN11 4NB	141.53	23.27	8.1	Rec 465	65.1	-3.9
31	SP5883962182	NN11 4NB	112.25	7.85	8.1	Rec 465	65.1	-3.9
32	SP5883962182	NN11 4NB	179.82	30.24	8.1	Rec 465	65.1	-3.9
33	SP5874962179	NN11 4NB	218.71	23.19	8.1	Rec 465	65.1	-3.9
34	SP5883962182	NN11 4NB	162.33	28.83	8.1	Rec 465	65.1	-3.9
35	TM2547745261	IP5 3RW	114.3	9.31	8.1	Rec 465	65.1	-3.9

Notes

(i) The licence issued to successful earth station applicants will include the following limit: emissions from the earth station shall not exceed a pfd level of -108.5 dBW/m²/MHz at 6m height above local terrain at a distance of 6 km from the earth station.

(ii) 'Azimuth' is the pointing direction of the dish, in degrees, with respect to grid north in a clockwise direction.

(iii) 'Elevation' is the pointing direction of the dish towards sky, in degrees, with respect to the horizontal.

Spectrum in the national 40 GHz band

2.3 In paragraphs 2.21 to 2.23 we explained that the spectrum band 42.5-43.5 GHz is currently used in the UK by the Radio Astronomy Service and that we were proposing to issue Recognised Spectrum Access (RSA) for this Service. Where we award an RSA for this band the Spectrum Quality Benchmark for the holder may effectively place a requirement on other operators in the band to protect Radio Astronomy. This will be that the Licensees who hold spectrum rights in the band 42.5 – 43.5 GHz will not be permitted to place transmitting stations within a 50 km ground distance radius of the location of a radio astronomy station. In paragraph 2.2 we showed two locations that might be covered in an RSA. We can confirm that only the one station shown in the table below will be covered by a Radio Astronomy Service RSA.

Radio Astronomy Station	Location (Longitude, Latitude)	
Cambridge	000°02'23"E	52°10'06"N

The Licences

Radio equipment: technical conditions

2.4 Paragraph 3.18 said that a valid site clearance certificate issued by Ofcom would be required for certain radio equipment and that any specific assignments made in the spectrum bands would be required to be notified to the National Frequency Assignment Panel (NFAP). It went on to say that both these processes were currently under review. The conclusion of the review was that both processes would be discontinued except in a limited set of circumstances. Licensees in the spectrum bands that operate satellite earth stations will continue to be subject to site clearance. The relevant condition (paragraph 4 of Schedule 1) has been amended in the draft Licence at Annex 1.

International co-ordination for terrestrial services in the 10, 28, 32 & 40 GHz bands

2.5 Paragraph 3.33 said that currently there were no Memorandums of Understanding between the UK and other countries where international co-ordination would be deemed appropriate for the spectrum bands. In paragraph 3.34 certain requirements were set out with which licensees awarded paired frequency ranges in the spectrum bands which they use for terrestrial services would have to comply. The requirements shown have been revised so that they are now as follows³:

For the time being, Licensees awarded Paired Frequency Ranges in these Bands which they use for terrestrial services will be notified by Ofcom under paragraph 6 of the Schedule to their Licences that they must comply with the following requirements:

- Limit: spectrum flux density (PFD) not exceeding $-115 \text{ dBW}/(\text{MHzxm}^2)$ at or beyond the geographical border of the neighbouring territory.
- Calculation; based on free space paths loss propagation⁴ and an atmospheric attenuation figure taken from annex 2, Figure 5 of ITU-R Recommendation P.676.
- Where a licensee can show that the pfd level can be met by demonstrating, via the use of an appropriate propagation model, that the pfd will not be exceeded, Ofcom will consider these instances on a case by case basis.

The Award Process

2.6 Ofcom has not changed its policy on the design of the award process in any major respect since publication of the Memorandum. However, the final version of the licence award regulations, which were made on 30 November 2007, contains some differences from the draft regulations published for consultation on 7 August 2007. For the most part these differences are changes to the organisation of material in the regulations or to the drafting of particular rules of the award process, but in a few cases we have decided to make what we consider to be minor changes to the design

³ The requirements have been derived from examples in ECC Report 76

<http://www.ero.dk/documentation/docs/doc98/official/pdf/ECCREP076.PDF>.

⁴ By using $L_{FS} = 94.442 + 20\text{Log}_{10}f_{\text{GHz}} + 20\text{Log}_{10}d_{\text{km}}$ where L_{FS} = Free space path loss in dB, f_{GHz} = frequency in GHz, d_{km} = distance in km.

of the award process and the drafting of the licence award regulations has been revised accordingly. These minor changes are described below.

- 2.7 The reorganisation of material in the regulations has resulted in some re-numbering of particular regulations that are referred to by number in the Memorandum. Annex 2 has a table that indicates where such numbering changes occur.

Assignment process where there is only one bidder

- 2.8 Paragraphs 4.39 to 4.44 set out the process to be followed where, following the last day for withdrawal, there is only one bidder. We have decided to introduce a cap on the number of lots that a bidder may select. Regulation 11(2)(c) now provides that the bidder must ensure that the total amount of the prices indicated on the paired frequency range selection menu for the paired frequency ranges included in the selection is not greater than £420,000.
- 2.9 Paragraph 4.42 said that where, due to the manner of completion, a Paired Frequency Range Selection Menu was incomplete or defective but Ofcom considered it could ascertain the relevant Bidder's intention in relation to the making of the selection it would follow the process set out in Regulations 11(5), (6) and (7) of the Regulations. Ofcom has decided that in circumstances where all of the selections of paired frequency ranges made by a bidder are rejected by Ofcom because of incompleteness or defect in respect of the paired frequency range selection menu completed by the bidder, the bidder's deposit should be forfeited. The provision giving effect to this rule is regulation 11(8). This rule is consistent with regulation 11(7)(b), which provides that the bidder's deposit is to be forfeited where the entire paired frequency range selection menu is rejected by Ofcom because of incompleteness or defect.

Making supplementary bids

- 2.10 Paragraph 4.89 said that in making a supplementary bid a bidder cannot submit a supplementary bids form containing more than 200 supplementary bids for selections of lots which are different from the selection of lots that were comprised in primary bids made by the bidder. Ofcom has decided that there should be no maximum limit on the number of such supplementary bids that a bidder may make.

Determination of base price of winning principal stage bids

- 2.11 Schedules 8 and 9 of the licence award regulations set out the requirements that must be met in the determination of base prices and additional prices. These have not changed in substance from the schedules to the draft regulations. However, Ofcom has published on its website an explanatory note on the existence and uniqueness of base and additional prices.

Associated Policy Issues

London 2012 Olympic Games and Paralympic Games

- 2.12 In paragraphs 5.7 to 5.17 we considered the relevance to the spectrum bands of the Government guarantee on availability of spectrum for the London 2012 Games. We said that, although it was not possible for the Secretary of State or Ofcom to fetter their discretion (as described in paragraph 5.16), neither expected to exercise its power, without the consent of the Licensee, to vary or revoke the licences being awarded under this award process for the purpose of meeting international

obligations of the United Kingdom relating to the Games. This remains the position. Interested parties may wish to know that on 30 November 2007 Ofcom published a discussion document that addresses issues that we must consider in planning spectrum use for the Games. The document can be found at <http://www.ofcom.org.uk/consult/condocs/spectrum2012/>.

Glasgow 2014 Commonwealth Games

- 2.13 Potential bidders should be aware that in Glasgow's successful bid to host the Commonwealth Games in 2014 the Government gave a similar guarantee on spectrum availability. As with the London Games, although it is not possible for the Secretary of State or Ofcom to fetter their discretion, neither expects to exercise its power, without the consent of the Licensee, to vary or revoke the licences being awarded under this award process for the purpose of meeting international obligations of the United Kingdom relating to the Glasgow Games.

Other Ofcom consultations

- 2.14 In paragraph 4.24 we said that Ofcom had published a consultation document on 12 April 2007 entitled 'Licence-Exemption Framework Review'. This addressed a range of issues related to the assignment and management of spectrum used by licence-exempt devices. The consultation closed on 21 June 2007. Ofcom has considered responses to the consultation and will shortly issue a statement setting out a framework for future decisions relating to specific bands⁵.

⁵ <http://www.ofcom.org.uk/consult/condocs/lefr/>

Annex 1

Draft Licence

Wireless Telegraphy Act 2006
Office of Communications (Ofcom)

SPECTRUM ACCESS LICENCE [BAND]

Note: The Permitted Frequency Bands in a particular licence will be determined by the outcome of the auction.

Licence no. **xxxxxx**

Date of issue: **xx xxxxx 2008**

1. The Office of Communications (Ofcom) grants this licence to

Company Name
Company Reg No: xxxxxx
("the Licensee")
Addressxxxxxx
xxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxx
xxxxxxxxxx
xxxxxxxxxx

to establish, install and use wireless telegraphy stations and/or wireless telegraphy apparatus as described in the schedule(s) ("the Radio Equipment") subject to the terms set out below.

Licence Term

2. This Licence shall continue in force until revoked by Ofcom in accordance with paragraph 3 below or surrendered by the Licensee.

Licence Variation and Revocation

3. Pursuant to Schedule 1(8) of the Wireless Telegraphy Act 2006 ("the Act") Ofcom may not revoke this Licence under Schedule 1(6) of the Act except:

- (a) at the request of, or with the consent of, the Licensee;
- (b) in accordance with paragraph 8 of this licence;
- (c) if there has been a breach of any of the terms of this Licence;

- (d) if, in connection with the transfer or proposed transfer of rights and obligations arising by virtue of the Licence, there has been a breach of any provision of regulations made by Ofcom under the powers conferred by section 30(1) and section 30(3) of the Act⁶;
 - (e) if the Licensee has been found to the reasonable satisfaction of Ofcom to have been involved in any act, or omission of any act, constituting a breach of the Wireless Telegraphy (Licence Award)(No. 2) Regulations 2007 (the "Regulations");
 - (f) in accordance with Schedule 1, paragraph 8(5) of the Act;
 - (g) if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purposes of complying with a direction by the Secretary of State given to Ofcom under section 5 of the Act or section 5 of the Communications Act 2003; or
 - (h) for reasons related to the management of the radio spectrum, provided that in such case:
 - (i) this power to revoke may only be exercised after at least five (5) year's notice is given in writing to the Licensee; and
 - (ii) such notice must expire after fifteen (15) years from the date of issue of this Licence.
4. Ofcom may only revoke or vary this Licence by notification in writing to the Licensee and in accordance with Schedule 1 (6) and (7) of the Act.

Changes

- 5. This Licence is not transferable. The transfer of rights and obligations arising by virtue of this Licence may however be authorised in accordance with regulations made by Ofcom under powers conferred by section 30(1) and section 30 (3) of the Act.
- 6. The Licensee must give prior notice to Ofcom in writing of any proposed change to the Licensee's name and address from that recorded in the Licence.

Fees

- 7. The licence fee in respect of this Licence is £xxxxxxxxxxxx which for the avoidance of doubt is exclusive of any VAT which may ultimately be payable.
- 8. On or after the expiry of fifteen (15) years from the date of issue of this Licence the Licensee shall pay to Ofcom such sum(s) as may be provided for in regulations made by Ofcom under sections 12 and 13(2) of the Act, failing which Ofcom may revoke this Licence.

⁶ These are regulations on spectrum trading.

9. The Licensee shall also pay interest to Ofcom on any amount which is due under the terms of this Licence or provided for in any regulations made by Ofcom under sections 12 and 13(2) of the Act, from the date such amount falls due until the date of payment, calculated with reference to the Bank of England base rate from time to time. In accordance with section 15 of the Act any such amount and any such interest is recoverable by Ofcom.
10. If the Licence is surrendered or revoked, no refund, whether in whole or in part of any amount which is due under the terms of this Licence or provided for in any regulations made by Ofcom under sections 12 and 13(2) of the Act will be made, except at the absolute discretion of Ofcom in accordance with regulation 72 of the Regulations, or any regulation made under those sections of the Act (as the case may be).

Radio Equipment Use

11. The Licensee must ensure that the Radio Equipment is established, installed and used only in accordance with the provisions specified in Schedule(s) of this licence. Any proposal to amend any detail specified in Schedule(s) of this Licence must be agreed with Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.
12. The Licensee must ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.

Access and Inspection

13. The Licensee shall permit a person authorised by Ofcom:
 - (a) to have access to the Radio Equipment; and
 - (b) to inspect this Licence and to inspect, examine and test the Radio Equipment,at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time to ensure the Radio Equipment is being used in accordance with the terms of this Licence.

Modification, Restriction and Closedown

14. A person authorised by Ofcom may require any of the radio stations or radio apparatus that comprise the Radio Equipment to be modified or restricted in use, or temporarily or permanently closed down immediately if in the opinion of the person authorised by Ofcom:
- (a) a breach of a term of the Licence has occurred; and/or
 - (b) the use of the Radio Equipment is causing or contributing to interference to the use of other authorised radio equipment.
15. Ofcom may require any of the wireless telegraphy stations or wireless telegraphy apparatus that comprise the Radio Equipment to be modified or restricted in use, or temporarily closed down either immediately or on the expiry of such period as may be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice is served on the Licensee or a general notice applicable to holders of a named class of Licence is published.

Interpretation

16. In this Licence:
- (a) the establishment, installation and use of the Radio Equipment shall be interpreted as establishment and use of stations and installation and use of apparatus for wireless telegraphy as specified in section 8(1) of the Act;
 - (b) the expression "interference" shall have the meaning given by section 115 of the Act;
 - (c) the expressions "wireless telegraphy apparatus" and "wireless telegraphy station" shall have the meanings given by section 117 of the Act.
17. The schedule to this Licence form part of this Licence together with any subsequent schedule(s) which Ofcom may issue as a variation to this Licence at a later date.
18. The Interpretation Act 1978 shall apply to the Licence as it applies to an Act of Parliament.

Issued by Ofcom

Signed by

For the Office of Communications

SCHEDULE [] TO LICENCE NUMBER: xxxxxx

Schedule for use where Licensee is assigned a paired frequency range in the National 10GHz Band.

Schedule Date: **xx xxxxx 2008**

Licence Category: **SPECTRUM ACCESS 10GHz**

1. Description of Radio Equipment Licensed

In this Licence, the Radio Equipment means any station or apparatus that transmits in accordance with the requirements of paragraphs 8 and 9 of this schedule.

2. Interface Requirements for the Radio Equipment use

The Radio Equipment shall comply with the following Interface Requirement:

IR2047 "Spectrum Access 10.125 to 10.225 paired with 10.475 to 10.575 GHz"

3. Special Conditions relating to the Operation of the Radio Equipment

- (a) During the period that this Licence remains in force and for 6 months thereafter, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of:
- (i) The following details relating to the Radio Equipment:
 - a) postal address;
 - b) National Grid Reference, (to 100 Metres resolution);
 - c) antenna height (above ground level) and type, bearing east of true north;
 - d) radio frequencies used by the Radio Equipment;
 - (ii) a statement of the number of subscribing customers;
- and the Licensee must produce these records if requested by a person authorised by Ofcom.
- (b) The Licensee shall inform Ofcom of the address of the premises at which this Licence and the information detailed at sub-paragraph 3(a) above shall be kept.
- (c) The Licensee must submit to Ofcom copies of the records detailed in sub-paragraph 3 (a) above at such intervals as Ofcom shall notify to the Licensee.

- (d) The Licensee must also submit to Ofcom in such manner and at such times, all information relating to the establishment, installation or use of the Radio Equipment, whether stored in hard copy or electronic form, as reasonably requested for the purposes of verifying compliance with this Licence or for statistical purposes.
- (e) The Licensee must ensure that the Radio Equipment is established and installed only for fixed terrestrial use, or for the use of wireless cameras.

4. Site Clearance Requirements

- (a) The Licensee must comply with any radio site clearance procedures notified by Ofcom;
- (b) the Licensee must put in place procedures to protect any military assignments within the Licensee’s Permitted Frequency Bands notified from time-to-time by Ofcom on behalf of the Ministry of Defence.

5. Co-ordination at Frequency and Geographical Boundaries

The Radio Equipment shall be operated in compliance with such co-ordination procedures as may be necessary and notified to the Licensee by Ofcom.

6. International Cross-border Coordination

The Licensee must ensure that the Radio Equipment is operated in compliance with such cross-border coordination and sharing procedures as may be notified to the Licensee by Ofcom.

7. Permitted Frequency Blocks

Subject to the out of block emissions permitted under paragraph 10, the Radio Equipment must only transmit on the following frequency bands (the “Permitted Frequency Blocks”):

Base Transmit

Base Receive

[10.125GHz to 10.225GHz - 10.475 to 10.575 GHz]

Note: The Permitted Frequency Blocks in a particular licence will be determined by the outcome of the auction.

8. Maximum Permissible (mean) e.i.r.p.

The maximum e.i.r.p. in the Permitted Frequency Blocks is:

[Where blocks of 2x20MHz are awarded]

Offset from edge of block	Maximum permitted level
Centre of block	24.6 dBW/MHz
Block edge when arrived at from in block	11 dBW/MHz

Linear interpolation between points

[Where blocks of 2x30MHz or larger are awarded]

Offset from edge of block	Maximum permitted level
In block	55 dBW (in any measured bandwidth)
-14 MHz of block edge	30 dBW/MHz
Block edge when arrived at from in block	11 dBW/MHz

Where - = in block

Linear interpolation between points

9. **Permissible Out of Block Emissions**

For out of block emissions (i.e. emissions outside the Permitted Frequency Block(s) specified in paragraph 7 at either the upper or lower edge), the maximum mean e.i.r.p. shall not exceed the following:

Offset from edge of block	Maximum permitted level
Block edge when moving out of block	-39 dBW/MHz
+14 MHz of block edge	-52 dBW/MHz

Where + = out of block

Linear interpolation between points

- Where an individual radiating antenna has a 3 dB beamwidth of less than 5°, then the values of out of block emissions, shown above, can be increased by 20 dB.

10. **Geographical Boundaries**

This Licence authorises the Licensee to establish, install and use the Radio Equipment only in the United Kingdom.

11. **Interpretation of terms in this Schedule**

In this Schedule:

- "e.i.r.p." means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain);
- "e.r.p." means the effective radiated power. This is the power fed to the antenna multiplied by the maximum gain of the antenna with respect to a half-wave dipole;
- "dBm" means the power level in decibels (logarithmic scale) referenced against 1 milli Watt (i.e. a value of 0 dBm is 1 mW);
- "dBW" means the power level in decibels (logarithmic scale) referenced against 1 Watt. (i.e. a value of 0 dBW is 1 W);
- "out of block emissions" means radio frequency emissions generated by the Radio Equipment and radiated into the frequency bands adjacent (in terms of frequency) to the licensee's permitted frequencies of operation;

SCHEDULE [] TO LICENCE NUMBER: xxxxxx

Schedule for use where Licensee is assigned a paired frequency range in the National 28GHz Band.

Schedule Date: **xx xxxxx 2008**

Licence Category: **SPECTRUM ACCESS 28GHz**

1. Description of Radio Equipment Licensed

In this Licence, the Radio Equipment means any station or apparatus that transmits in accordance with the requirements of paragraphs 7, 8, 9 and 10 of this schedule.

2. Interface Requirements for the Radio Equipment use

The Radio Equipment shall comply with the following Interface Requirement:

IR2048 "Spectrum Access 27.8285 to 28.4445 paired with 28.8365 to 29.4525 GHz"

3. Special Conditions relating to the Operation of the Radio Equipment

(a) During the period that this Licence remains in force and for 6 months thereafter, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of:

(i) The following details relating to the Radio Equipment:

a) postal address;

b) National Grid Reference, (to 100 Metres resolution);

c) antenna height (above ground level) and type, bearing east of true north;

d) radio frequencies used by the Radio Equipment;

(ii) a statement of the number of subscribing customers,

and the Licensee must produce these records if requested by a person authorised by Ofcom.

(b) The Licensee shall inform Ofcom of the address of the premises at which this Licence and the information detailed at sub-paragraph 3(a) above shall be kept.

(c) The Licensee must submit to Ofcom copies of the records detailed in sub-paragraph 3 (a) above at such intervals as Ofcom shall notify to the Licensee.

- (d) The Licensee must also submit to Ofcom in such manner and at such times, all information relating to the establishment, installation or use of the Radio Equipment, whether stored in hard copy or electronic form, as reasonably requested for the purposes of verifying compliance with this Licence or for statistical purposes.
- (e) The Licensee must ensure that the Radio Equipment is established and installed only for terrestrial or satellite (Earth to space) use.

4. Site Clearance Requirements

The Licensee must comply with any radio site clearance procedures notified by Ofcom.

5. Co-ordination at Frequency and Geographical Boundaries

The Radio Equipment shall be operated in compliance with such co-ordination procedures as may be necessary and notified to the Licensee by Ofcom.

6. International Cross-border Coordination

The Licensee must ensure that the Radio Equipment is operated in compliance with such cross-border coordination and sharing procedures as may be notified to the Licensee by Ofcom.

7. Permitted Frequency Blocks

Subject to the out of block emissions permitted under paragraph 9, the Radio Equipment must only transmit on the following frequency bands (the “Permitted Frequency Blocks”):

Base Transmit

Base Receive

[27.8285 to 27.9405 GHz - 28.8365 to 28.9485 GHz]
 [27.9405 to 28.0525 GHz - 28.9485 to 29.0605 GHz]

Note: The Permitted Frequency Blocks in a particular licence will be determined by the outcome of the auction.

8. Maximum Permissible (mean) e.i.r.p. (terrestrial services)

The maximum eirp power for terrestrial services in the Permitted Frequency Blocks is:

Offset from edge of block	Maximum permitted level
In block	55 dBW (in any measured bandwidth)
-14 MHz of block edge	30 dBW/MHz
Block edge when arrived at from in block	11 dBW/MHz

Where - = in block
 Linear interpolation between points

9. Permissible Out of Block Emissions (terrestrial services)

For out of block emissions (i.e. emissions outside the Permitted Frequency Block(s) specified in paragraph 7 at either the upper or lower edge), the maximum mean e.i.r.p. shall not exceed the following:

Offset from edge of block	Maximum permitted level
Block edge when moving out of block	-39 dBW/MHz
+14 MHz of block edge	-52 dBW/MHz

Where + = out of block

Linear interpolation between points

- Where an individual radiating antenna has a 3 dB beamwidth of less than 5°, then the values of out of block emissions, shown above, can be increased by 20 dB.

10. **Deployment Requirements (satellite services)**

- The elevation angle of the main beam of the transmitting earth station shall be higher than 10° above the horizontal;
- the off axis e.i.r.p. density radiated into spectrum immediately adjacent to the licensed frequency block shall be limited to -35 dBW/MHz (off axis refers to angles greater than 7° from the axis of the main beam of transmission) except into the spectrum between; 27.5 GHz to 27.8285 GHz, 28.4445 GHz to 28.8365 GHz & 29.4525 to 29.5 GHz where this limit will not apply and where only spurious emission limits will then apply;
- satellite earth stations shall not have their transmitted occupied band edges closer than 10 MHz from the edge of the frequency blocks as referred to in the table in Paragraph 7 except where that block edge directly abuts spectrum at 27.8285 GHz and 28.8365 GHz.

11. **Geographical Boundaries**

This Licence authorises the Licensee to establish, install and use the Radio Equipment only in the United Kingdom.

12. **Interpretation of terms in this Schedule**

In this Schedule:

- "e.i.r.p." means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain);
- "e.r.p." means the effective radiated power. This is the power fed to the antenna multiplied by the maximum gain of the antenna with respect to a half-wave dipole.
- "dBm" means the power level in decibels (logarithmic scale) referenced against 1 milli Watt (i.e. a value of 0 dBm is 1 mW);

- (d) “dBW” means the power level in decibels (logarithmic scale) referenced against 1 Watt. (i.e. a value of 0 dBW is 1 W);
- (e) “out of block emissions” means radio frequency emissions generated by the Radio Equipment and radiated into the frequency bands adjacent (in terms of frequency) to the licensee’s permitted frequencies of operation;
- (f) “Terrestrial” means radio transmission on the ground to other ground based systems, but excludes transmission to or between satellite systems;
- (g) “Satellite” means radio transmission which forms of an intended communication between systems on the ground and systems that go beyond, or has been beyond, the major portion of the earth’s atmosphere.

SCHEDULE [] TO LICENCE NUMBER: xxxxxx

Schedule for use where Licensee is assigned a paired frequency range in the sub-national 28GHz Band.

Schedule Date: **xx xxxxx 2008**

Licence Category: **SPECTRUM ACCESS 28GHz**

1. Description of Radio Equipment Licensed

In this Licence, the Radio Equipment means any station or apparatus that transmits in accordance with the requirements of paragraphs 7, 8, 9 and 10 of this schedule.

2. Interface Requirements for the Radio Equipment use

The Radio Equipment shall comply with the following Interface Requirement:

IR2048 "Spectrum Access 27.8285 to 28.4445 paired with 28.8365 to 29.4525 GHz"

3. Special Conditions relating to the Operation of the Radio Equipment

- (a) During the period that this Licence remains in force and for 6 months thereafter, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of:
 - (i) The following details relating to the Radio Equipment:
 - a) postal address;
 - b) National Grid Reference, (to 100 Metres resolution);
 - c) antenna height (above ground level) and type, bearing east of true north;
 - d) radio frequencies used by the Radio Equipment;
 - (ii) a statement of the number of subscribing customers,
and the Licensee must produce these records if requested by a person authorised by Ofcom.
- (b) The Licensee shall inform Ofcom of the address of the premises at which this Licence and the information detailed at sub-paragraph 3(a) above shall be kept.
- (c) The Licensee must submit to Ofcom copies of the records detailed in sub-paragraph 3 (a) above at such intervals as Ofcom shall notify to the Licensee.

- (d) The Licensee must also submit to Ofcom in such manner and at such times, all information relating to the establishment, installation or use of the Radio Equipment, whether stored in hard copy or electronic form, as reasonably requested for the purposes of verifying compliance with this Licence or for statistical purposes.
- (e) The Licensee must ensure that the Radio Equipment is established and installed only for terrestrial or satellite (Earth to space) use.

4. Site Clearance Requirements

The Licensee must comply with any radio site clearance procedures notified by Ofcom.

5. Co-ordination at Frequency and Geographical Boundaries

The Radio Equipment shall be operated in compliance with such co-ordination procedures as may be necessary and notified to the Licensee by Ofcom.

6. International Cross-border Coordination

The Licensee must ensure that the Radio Equipment is operated in compliance with such cross-border coordination and sharing procedures as may be notified to the Licensee by Ofcom.

7. Permitted Frequency Blocks

Subject to the out of block emissions permitted under paragraph 9, the Radio Equipment must only transmit on the following frequency bands (the “Permitted Frequency Blocks”):

Base Transmit	-	Base Receive
[28.0525 to 28.1645 GHz	-	29.0605 to 29.1725 GHz]
[28.1925 to 28.3045 GHz	-	29.2005 to 29.3125 GHz]
[28.3325 to 28.4445 GHz	-	29.3405 to 29.4525 GHz]

Note: The Permitted Frequency Blocks in a particular licence will be determined by the outcome of the auction.

8. Maximum Permissible (mean) e.i.r.p. (terrestrial services)

The maximum e.i.r.p. power in the Permitted Frequency Blocks is:

Offset from edge of block	Maximum permitted level
In block	55 dBW (in any measured bandwidth)
-14 MHz of block edge	30 dBW/MHz
Block edge when arrived at from in block	11 dBW/MHz

Where - = in block
Linear interpolation between points

9. Permissible Out of Block Emissions (terrestrial services)

For out of block emissions (i.e. emissions outside the Permitted Frequency Block(s) specified in paragraph 7 at either the upper or lower edge), the maximum mean e.i.r.p. shall not exceed the following:

Offset from edge of block	Maximum permitted level
Block edge when moving out of block	-39 dBW/MHz
+14 MHz of block edge	-52 dBW/MHz

Where + = out of block

Linear interpolation between points

- Where an individual radiating antenna has a 3 dB beamwidth of less than 5°, then the values of out of block emissions, shown above, can be increased by 20 dB.

10. Deployment Requirements (satellite services)

- The elevation angle of the main beam of the transmitting earth station shall be higher than 10° above the horizontal;
- the off axis e.i.r.p. density radiated into spectrum immediately adjacent to the licensed frequency block shall be limited to -35 dBW/MHz (off axis refers to angles greater than 7° from the axis of the main beam of transmission) except into the spectrum between; 27.5 GHz to 27.8285 GHz, 28.4445 GHz to 28.8365 GHz and 29.4525 to 29.5 GHz where this limit will not apply and where only spurious emission limits will then apply;
- satellite earth stations shall not have their transmitted occupied band edges closer than 10 MHz from the edge of the frequency blocks as referred to in the table in Paragraph 7 except where that block edge directly abuts spectrum at, 28.4445 GHz and 29.4525 GHz.

11. Geographical Boundaries

This Licence authorises the Licensee to establish, install and use the Radio Equipment only in the area for the [first/second/third] sub-national 28GHz lot shown in figure A6.2 of the Information Memorandum for 10GHz, 28GHz, 32GHz and 40GHz, published on 07/08/07.

(http://www.ofcom.org.uk/radiocomms/spectrumawards/awardspending/award_10_40/10-40IM.pdf)

12. Interpretation of terms in this Schedule

In this Schedule:

- (a) "e.i.r.p." means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain);
- (b) "e.r.p." means the effective radiated power. This is the power fed to the antenna multiplied by the maximum gain of the antenna with respect to a half-wave dipole;
- (c) "dBm" means the power level in decibels (logarithmic scale) referenced against 1 milli Watt (i.e. a value of 0 dBm is 1 mW);
- (d) "dBW" means the power level in decibels (logarithmic scale) referenced against 1 Watt. (i.e. a value of 0 dBW is 1 W);
- (e) "out of block emissions" means radio frequency emissions generated by the Radio Equipment and radiated into the frequency bands adjacent (in terms of frequency) to the licensee's permitted frequencies of operation;
- (f) "Terrestrial" means radio transmission on the ground to other ground based systems, but excludes transmission to or between satellite systems;
- (g) "Satellite" means radio transmission which forms of an intended communication between systems on the ground and systems that go beyond, or has been beyond, the major portion of the earth's atmosphere;

SCHEDULE [] To LICENCE NUMBER:xxxxxxx

Schedule for use where Licensee is assigned a paired frequency range in the National 32 GHz Band.

Schedule Date :xx xxxxx xx

Licence Category: **SPECTRUM ACCESS 32GHz**

Note: The Permitted Frequency Blocks in a particular licence will be determined by the outcome of the auction.

1. Description of Radio Equipment Licensed

In this Licence, the Radio Equipment means any station or apparatus that transmits in accordance with the requirements of paragraph 7, 8 and 9 of this schedule.

2. Interface Requirements for the Radio Equipment use

The Radio Equipment shall comply with the following Interface Requirement:

IR2049 "Spectrum Access 32 GHz"

3. Special Conditions relating to the Operation of the Radio Equipment

- (a) During the period that this Licence remains in force and for 6 months thereafter, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of:
 - (i) The following details relating to the Radio Equipment:
 - (a) postal address;
 - (b) National Grid Reference, (to 100 metres resolution);
 - (c) antenna height (above ground level) and type, bearing east of true north;
 - (d) radio frequencies used by the Radio Equipment;
 - (ii) a statement of the number of subscribing customers,
and the Licensee must produce these records if requested by a person authorised by Ofcom.
- (b) The Licensee shall inform Ofcom of the address of the premises at which this Licence and the information detailed at sub-paragraph 3(a) above shall be kept.
- (c) The Licensee must submit to Ofcom copies of the records detailed in sub-paragraph 3(a) above at such intervals as Ofcom shall notify to the Licensee.

- (d) The Licensee must also submit to Ofcom in such manner and at such times, all information relating to the establishment, installation or use of the Radio Equipment, whether stored in hard copy or electronic form, as reasonably requested for the purposes of verifying compliance with this Licence or for statistical purposes.
- (e) The Licensee must ensure that the Radio Equipment is established and installed only for terrestrial use.

4. Site Clearance Requirements

The Licensee must comply with any radio site clearance procedures notified by Ofcom.

5. Co-ordination at Frequency and Geographical Boundaries

The Radio Equipment shall be operated in compliance with such co-ordination procedures as may be necessary and notified to the Licensee by Ofcom.

6. International Cross-border Coordination

The Licensee must ensure that the Radio Equipment is operated in compliance with such cross-border coordination and sharing procedures as may be notified to the Licensee by Ofcom.

7. Permitted Frequency Blocks

Subject to the out of block emissions permitted under paragraph 9, the Radio Equipment must only transmit on the following frequency bands (the “Permitted Frequency Blocks”):

Base Transmit	-	Base Receive
[31.815 to 31.941 GHz	-	32.627 to 32.753 GHz]
[31.941 to 32.067 GHz	-	32.753 to 32.879 GHz]
[32.067 to 32.193 GHz	-	32.879 to 33.005 GHz]
[32.193 to 32.319 GHz	-	33.005 to 33.131 GHz]
[32.319 to 32.445 GHz	-	33.131 to 33.257 GHz]
[32.445 to 32.571 GHz	-	33.257 to 33.383 GHz]

Note: The Permitted Frequency Blocks in a particular licence will be determined by the outcome of the auction.

8. Maximum permissible (mean) e.i.r.p.

The maximum e.i.r.p. power in the Permitted Frequency Blocks is;

Offset from edge of block	Maximum permitted level
In block	55 dBW (in any measured bandwidth)
-14 MHz of block edge	30 dBW/MHz
Block edge when arrived at from in block	11 dBW/MHz

Where - = in block

Linear interpolation between points

9. **Permissible Out of Block Emissions**

For out of block emissions (i.e. emissions outside the Permitted Frequency Block(s) specified in paragraph 7 at either the upper or lower edge), the maximum mean e.i.r.p. shall not exceed the following:

Offset from edge of block	Maximum permitted level
Block edge when moving out of block	-39 dBW/MHz
+14 MHz of block edge	-52 dBW/MHz

Where + = out of block

Linear interpolation between points

Where an individual radiating antenna has a 3 dB beamwidth of less than 5°, then the values of out of block emissions, shown above, can be increased by 20 dB.

10. **Geographical Boundaries**

This Licence authorises the Licensee to establish, install and use the Radio Equipment only in the United Kingdom.

11. **Interpretation of terms in this Schedule**

In this Schedule:

- (a) "e.i.r.p." means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain);
- (b) "e.r.p." means the effective radiated power. This is the power fed to the antenna multiplied by the maximum gain of the antenna with respect to a half-wave dipole;
- (c) "dBm" means the power level in decibels (logarithmic scale) referenced against 1 milli Watt. (i.e. a value of 0 dBm is 1 mW);
- (d) "dBW" means the power level in decibels (logarithmic scale) referenced against 1 watt. (i.e. a value of 0 dBW is 1 W);
- (e) "out of block emissions" means radio frequency emissions generated by the Radio Equipment and radiated into the frequency bands adjacent (in terms of frequency) to the licensee's permitted frequencies of operation;

SCHEDULE [] To LICENCE NUMBER:xxxxxxx

Schedule for use where Licensee is assigned a paired frequency range in the National 40 GHz Band.

Schedule Date :xx xxxxx xx

Licence Category: **SPECTRUM ACCESS 40GHz**

Note: The Permitted Frequency Blocks in a particular licence will be determined by the outcome of the auction.

1. Description of Radio Equipment Licensed

In this Licence, the Radio Equipment means any station apparatus that transmits in accordance with the requirements of paragraph 7, 8, 9 and 10 of this schedule.

2. Interface Requirements for the Radio Equipment use

The Radio Equipment shall comply with the following Interface Requirement:

IR2049 "Spectrum Access 40 GHz"

3. Special Conditions relating to the Operation of the Radio Equipment

- (a) During the period that this Licence remains in force and for 6 months thereafter, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of:
- (i) The following details relating to the Radio Equipment:
 - (a) postal address;
 - (b) National Grid Reference, (to 100 metres resolution);
 - (c) antenna height (above ground level) and type, bearing east of true north;
 - (d) radio frequencies used by the Radio Equipment;
 - (ii) a statement of the number of subscribing customers;
- and the Licensee must produce these records if requested by a person authorised by Ofcom.
- (b) The Licensee shall inform Ofcom of the address of the premises at which this Licence and the information detailed at sub-paragraph 3(a) above shall be kept.
- (c) The Licensee must submit to Ofcom copies of the records detailed in sub-paragraph 3(a) above at such intervals as Ofcom shall notify to the Licensee.
- (d) The Licensee must also submit to Ofcom in such manner and at such times, all information relating to the establishment, installation or use of the Radio

Equipment, whether stored in hard copy or electronic form, as reasonably requested for the purposes of verifying compliance with this Licence or for statistical purposes.

- 42.5 (e) The Licensee must ensure that the Radio Equipment is established and installed only for terrestrial use [or for satellite use (Earth to space) in the – 43.5 GHz band – Clause dependant upon whether licence grants rights to use the spectrum between 42.5 – 43.5 GHz].

4. Site Clearance Requirements

The Licensee must comply with any radio site clearance procedures notified by Ofcom.

5. Co-ordination at Frequency and Geographical Boundaries

- (a) The Radio Equipment shall be operated in compliance with such co-ordination procedures as may be necessary and notified to the Licensee by Ofcom.
- (b) Licensees who hold spectrum rights in the band 42.5 – 43.5 GHz will not be permitted to place transmitting stations within a 50 km ground distance of the following radio astronomy location:

radius

Radio Astronomy Station	Location (Longitude, Latitude)	
Cambridge	000°02'23"E	52°10'06"N

6. International Cross-border Coordination

The Licensee must ensure that the Radio Equipment is operated in compliance with such cross-border coordination and sharing procedures as may be notified to the Licensee by Ofcom.

7. Permitted Frequency Blocks

Subject to the out of block emissions permitted under paragraph 9, the Radio Equipment must only transmit on the following frequency bands (the “Permitted Frequency Blocks”):

Base Transmit		Base Receive
[40.50 to 40.75 GHz	-	42.00 to 42.25 GHz]
[40.75 to 41.00 GHz	-	42.25 to 42.50 GHz]
[41.00 to 41.25 GHz	-	42.50 to 42.75 GHz]
[41.25 to 41.50 GHz	-	42.75 to 43.00 GHz]

[41.50 to 41.75 GHz - 43.00 to 43.25 GHz]

[41.75 to 42.00 GHz - 43.25 to 43.50 GHz]

Note: The Permitted Frequency Blocks in a particular licence will be determined by the outcome of the auction.

8. Maximum permissible (mean) e.i.r.p. (terrestrial services)

The maximum e.i.r.p. power in the Permitted Frequency Blocks is:

Offset from edge of block	Maximum permitted level
In block	55 dBW (in any measured bandwidth)
-14 MHz of block edge	30 dBW/MHz
Block edge when arrived at from in block	11 dBW/MHz

Where - = in block

Linear interpolation between points

9. Permissible Out of Block Emissions (terrestrial services)

For out of block emissions (i.e. emissions outside the Permitted Frequency Block(s) specified in paragraph 7 at either the upper or lower edge), the maximum mean e.i.r.p. shall not exceed the following:

Offset from edge of block	Maximum permitted level
Block edge when moving out of block	-39 dBW/MHz
+14 MHz of block edge	-52 dBW/MHz

Where + = out of block

Linear interpolation between points

- Where an individual radiating antenna has a 3 dB beamwidth of less than 5°, then the values of out of block emissions, shown above, can be increased by 20 dB.

10. Deployment Requirements(satellite services in the band 42.5 – 43.5 GHz)

- The elevation angle of the main beam of the transmitting earth station shall be higher than 10° above the horizontal;
- the off axis e.i.r.p. density radiated into spectrum immediately adjacent to the licensed frequency block shall be limited to -35 dBW/MHz (off axis refers to angles greater than 7° from the axis of the main beam of transmission);
- satellite earth stations shall not have their transmitted occupied band edges closer than 10 MHz from the edge of the frequency blocks as referred to in the table in Paragraph 7;

11. Geographical Boundaries

This Licence authorises the Licensee to establish, install and use the Radio Equipment only in the United Kingdom.

12. Interpretation of terms in this Schedule

In this Schedule:

- (a) “e.i.r.p.” means the equivalent isotopically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain);
- (b) “e.r.p.” means the effective radiated power. This is the power fed to the antenna multiplied by the maximum gain of the antenna with respect to a half-wave dipole;
- (c) “dBm” means the power level in decibels (logarithmic scale) referenced against 1 milli Watt. (i.e. a value of 0 dBm is 1 mW);
- (d) “dBW” means the power level in decibels (logarithmic scale) referenced against 1 Watt. (i.e. a value of 0 dBW is 1 W);
- (e) “out of block emissions” means radio frequency emissions generated by the Radio Equipment and radiated into the frequency bands adjacent (in terms of frequency) to the licensee’s permitted frequencies of operation;
- (f) “Terrestrial” means radio transmission on the ground to other ground based systems, but excludes transmission to or between satellite systems.
- (g) “Satellite” means radio transmission which forms of an intended communication between systems on the ground and systems that go beyond, or has been beyond, the major portion of the earth’s atmosphere.

Annex 2

Changes to the numbering of regulations referred to in the Information Memorandum

Information Memorandum paragraph number	Regulation cited	
	Draft regulation number	Final regulation number
4.42	11	11 (no change)
4.47	27	29
4.47	36	36 (no change)
4.47	54	52
4.54	17(4)	19(4)
4.72	29	30
4.74	27	29
4.76	32	33
4.80	16(4)	18(4)
4.93	38	38 (no change)
4.120	45(4)	45(5)
4.121	45(6),(7) and (8)	45(7),(8) and (9)
4.125	48(2)	48(2) (no change)
4.132	56	54
4.133	54	52
4.156	66	66 (no change)