

SPECTRUM ACCESS FRMCS 1900-1910 MHz LICENCE

Office of Communications (Ofcom)
Wireless Telegraphy Act 2006

Licence number: [xx]
Date of issue: [xx]
Date of commencement: [xx]
Fee Payment date: [xx]
Payment interval: [xx]

1. The Office of Communications (Ofcom) grants this wireless telegraphy licence ("the Licence") to:

[XXX - Licensee's name]
(Company registration number [XXX])
("the Licensee")
[XXX – address of licensee's registered office]

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

Licence Term

2. This Licence shall come into force from the date of commencement and shall continue in force until revoked by Ofcom or surrendered by the Licensee.

Licence Variation and Revocation

3. Pursuant to schedule 1 paragraph 8 of the Wireless Telegraphy Act 2006 ("the Act"), Ofcom may not revoke this Licence under schedule 1 paragraph 6 of the Act except:
 - a) at the request of, or with the consent of, the Licensee;
 - b) if there has been a breach of any of the conditions of this Licence;

- c) 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 Act¹;
 - d) in accordance with schedule 1, paragraph 8(5) of the Act;
 - e) 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;
 - f) for reasons related to the management of the radio spectrum, provided that in such case the power to revoke may only be exercised after at least five years' notice is given in writing.
4. Where Ofcom exercise their power to revoke or vary the Licence in accordance with schedule 1 paragraph 6 of the Act, the Licensee shall be notified in writing or by a general notice. Any general notices will be posted on the Ofcom [website](#).

Transfer

5. This Licence may not be transferred. 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 of the Act².

Changes to Licensee Details

6. The Licensee must give immediate notice to Ofcom in writing of any changes to the Licensee's name and/or address from that recorded on the Licence.

Fees

7. The Licensee shall each year pay to Ofcom the relevant fee(s) as provided in section 12 of the Act and the regulations made thereunder:
- a) on or before the date of issue of the Licence; and
 - b) on or before the fee payment date shown on the Licence for subsequent payments or such other date or dates as shall be notified in writing to the Licensee in accordance with those regulations and any relevant terms, provisions and limitations of the Licence.

Radio Equipment Use

8. The Licensee must ensure that the Radio Equipment is established, installed and used only in accordance with the provisions specified in the schedules to this Licence. Any proposal to amend any detail specified in any of the schedules to this Licence must be agreed with

¹ These are regulations on spectrum trading.

² See Ofcom's website for the latest position on spectrum trading and the types of trade which are permitted.

Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.

9. 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.
10. The Licensee must ensure that the establishment, installation, modification or use of the Radio Equipment is carried out in accordance with the provisions set out in Schedule 1, Schedule 2 and Schedule 3 of this Licence.

Access and Inspection

11. The Licensee shall permit any person authorised by Ofcom:

- a) to have access to the Radio Equipment; and
- b) to inspect this Licence and to inspect 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

12. Any person authorised by Ofcom may require the Radio Equipment or any part thereof, 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 this Licence has occurred; and/or
- b) the use of the Radio Equipment is, or may be, causing or contributing to undue interference to the use of other authorised radio equipment.

13. Ofcom may require any of 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 has been served on the Licensee or a general notice applicable to holders of a named class of licence has been published.

Geographical Boundaries

14. Subject to the requirements of any coordination procedures notified to the Licensee pursuant to the Schedules to this Licence, the Licensee is authorised to establish, install and use the Radio Equipment as set out in Schedule 2.

Interpretation

15. In this Licence:

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

Issued by Ofcom

Office of Communications

SCHEDULE 1 TO LICENCE NUMBER: [xxx]

Licence category: Spectrum Access FRMCS 1900–1910 MHz

Description of Radio Equipment

1. References in this schedule to the Radio Equipment are references to any wireless telegraphy station or wireless telegraphy apparatus that is established, installed and/or used to form part of a radio telecommunications network ("the Network") used for operational railway business only, in which mobile user stations communicate by radio with the Radio Equipment to provide a telecommunications service.

Interface Requirements for the Radio Equipment

2. Use of the Radio Equipment shall be in accordance with the following Interface Requirements:

[PLACEHOLDER: For the Interface Requirement (IR) that will apply to this licence].

Special conditions relating to the Radio Equipment

3. Subject to paragraphs 4 and 5 of this schedule, during the period that this Licence remains in force, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of the following details relating to the Radio Equipment:
 - a) National Grid Reference, to at least 10 metre resolution;
 - b) antenna height (above ground level), type, and boresight bearing east of true north (if applicable);
 - c) radio frequencies which the Radio Equipment uses; and
 - d) transmitted power expressed in EIRP per cell;

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

4. The conditions relating to the keeping of records contained in sub-paragraphs 3(b) and (c) of this schedule shall not apply in respect of smart/intelligent low power repeater equipment.
5. The Licensee shall submit to Ofcom copies of the records detailed in paragraph 3 above at such intervals as Ofcom may notify to the Licensee.
6. The Licensee shall submit to Ofcom in such manner and within such period as specified by Ofcom, such other information in relation to the Radio Equipment, or any wireless telegraphy station or wireless telegraphy apparatus which the Licensee is planning to use, as Ofcom may from time-to-time request. Such information may include, but is not limited to, information in relation to the radio frequency, transmitted power and date of first use for

wireless telegraphy stations or wireless telegraphy apparatus to be established, installed or used within such timeframe and in such areas as Ofcom may reasonably request.

7. The licensee must immediately notify Ofcom when the total route length, as specified in Schedule 2 or where a notification is made under this condition as specified in that subsequent notification, increases or reduces, such that the total route length (when rounded up to the nearest 100 miles) changes. The licensee is not required to notify Ofcom for changes in the length of the route covered by the licence when the total route length (when rounded up to the nearest 100 miles) remains the same. **[This notification requirement does not apply to licences with a geographic scope of “Great Britain” or “Northern Ireland”.]**

Coordination

8. The Licensee shall ensure that the Radio Equipment is operated in compliance with such coordination procedures as may be notified to the Licensee by Ofcom from time to time.
9. The Licensee must liaise and co-operate with all co-channel FRMCS Licensees, both existing and future, with overlapping or adjacent coverage areas (if necessary adjusting transmission power and other technical parameters of transmission) in such a way that harmful interference is not caused by one network deployment to the network of another co-channel Licensee.

International cross-border co-ordination

10. The Licensee shall ensure that the Radio Equipment is operated in compliance with such cross-border co-ordination and sharing procedures as may be notified to the Licensee by Ofcom from time to time.

Permitted Frequency Blocks

11. Subject to any emissions requirements in this schedule, the Radio Equipment may only transmit within the following frequency bands (the “Permitted Frequency Blocks”)

Uplink and Downlink Frequencies
1900–1910 MHz

Permitted deployment location

12. The Network shall only operate in the geographic boundary defined in Schedule 2 of this Licence.

Maximum power within the Permitted Frequency Blocks

13. Subject to any more restrictive limitations imposed by the coordination requirements notified by Ofcom in accordance with paragraphs 9 and 10 of this schedule, the power transmitted in the Permitted Frequency Blocks shall not exceed:

Radio Equipment	Maximum mean EIRP
Base Station	65 dBm/10 MHz

User Terminals

Radio Equipment	Maximum mean EIRP
Cab Radio	31 dBm/10 MHz
Railway Mobile Radio Terminal	23 dBm/10 MHz
Uplink Power control is required for all FRMCS UEs	

Maximum power outside the Permitted Frequency Blocks

14. The maximum mean EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks, but within the frequency ranges listed in the following table, shall not exceed the least restrictive of the requirements in the following table:

Base Station

Frequency Range (MHz)	Maximum mean EIRP
1880–1900	20 dBm/5 MHz
1910–1915	20 dBm/5 MHz
1915–1920	15 dBm/5 MHz
1920–1980	-43 dBm/5MHz

Cab Radio Station

Frequency Range (MHz)	Maximum mean EIRP
1880–1900	-2 dBm/MHz
1910–1915	-2 dBm/MHz
1915–1920	-5 dBm/MHz
1920–1980	-30 dBm/MHz

Frame structure

15. Radio Equipment shall use Time Division Duplex (TDD) operation with any frame structure compatible with TD-LTE frame and subframe configurations.
16. When transmitting, the Licensee must transmit within the limits of the following frame structure:
- Transmissions from the Licensee's base stations may use any convenient LTE-TD frame structure;
 - Timeslots must have a duration of 1 millisecond;

- c) The Licensee shall ensure that frames start at a common reference time so that all licensees' frames are aligned

Interpretation of terms in this schedule

17. In this schedule:

- a) "AAS" means active antenna system. An AAS is a base station and antenna system where the amplitude and / or phase between antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This is not intended to include long term beam shaping such as fixed electrical down tilt. In AAS base stations the antenna system is integrated as part of the base station system or product;
- b) "Cab Radio" means an RMR terminal installed on-board the train capable of supporting voice and data applications;
- c) "dBm" means the power level in decibels (logarithmic scale) referenced against 1 milliwatt (i.e. a value of 0 dBm is 1 milliwatt);
- d) "Downlink" means transmissions from a base station or repeater to a terminal station (handset);
- e) "EIRP" means the effective 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);
- f) "Fixed or installed" means used or installed at specific fixed points;
- e) "FRMCS" means Future Railway Mobile Communications System. This will support voice communications between the train driver and signaller and greater digitalisation of the UK's railways;
- f) "IR" means a United Kingdom Radio Interface Requirement notified by Ofcom in accordance with the Radio Equipment Regulations 2017, as amended by the Product Safety and Metrology etc. (Amendment etc.) (EU Exit) Regulations 2019;
- g) "per cell" means per specific piece of Radio Equipment. For a multi-sector base station, per cell refers to each one of the individual sectors irrespective of the number of transmit antennas;
- h) "Permitted Frequency Blocks" has the meaning given to it in paragraph 16 of this schedule;
- i) "Railway mobile radio (RMR) terminal" means Radio Equipment transmitting on the uplink frequencies, which operates at a power not exceeding 24 dBm EIRP per carrier which may be established by customers of the Network but which are or will be used only by and under the control of the Network, following the establishment of a telecommunications link between the femtocell and the Network;

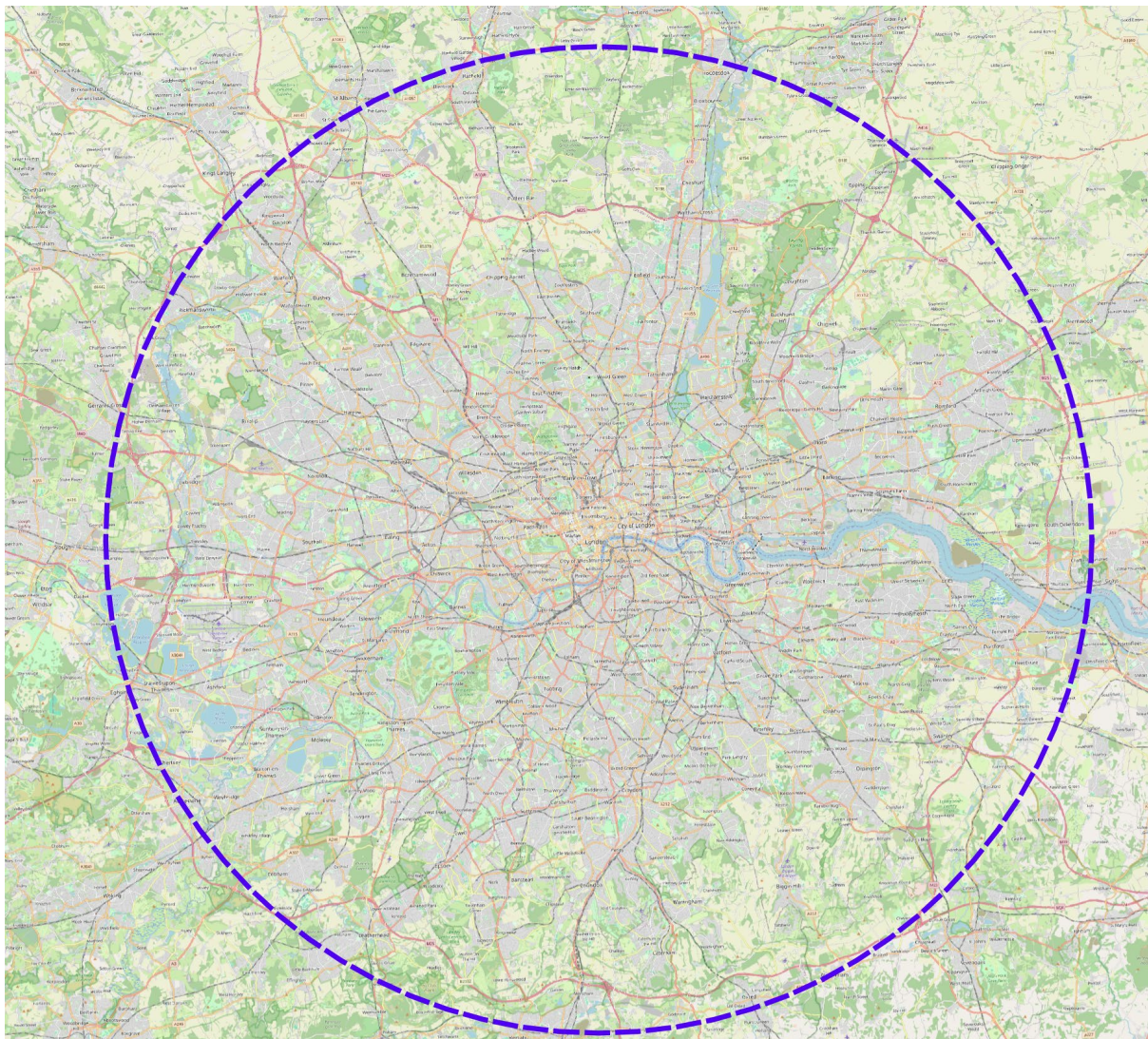
- j) “smart/intelligent low power repeater” means a repeater which operates with power not exceeding 24 dBm EIRP per carrier, which may be established by customers of the Licensee who have written agreements with the Licensee and:
 - i) The Licensee has ultimate control of the repeater, i.e. each individual repeater can be disabled remotely by the Licensee;
 - ii) The repeater operates only on the Licensee’s frequencies and with their valid Public Land Mobile Network Identifier;
 - iii) Must not cause undue interference to other spectrum users; and
 - iv) The repeater only transmits on the uplink timeslot when actively carrying a call (voice, video or data) or signalling from serviced handsets.
- k) “TDD” (Time Division Duplex) means the application of time-division multiplexing to separate uplink and downlink signals;

SCHEDULE 2 TO LICENCE NUMBER [XXXX]

Geographical boundary

1. This Schedule defines the geographic boundary of the licence.
2. **[EXAMPLE 1 – LICENCE COVERING GREAT BRITAIN:** This Licence authorises the Licensee to establish, install and use the Radio Equipment anywhere in England, Scotland or Wales.]
3. **[EXAMPLE 2 – LICENCE COVERING A SMALLER GEOGRAPHIC AREA:** This Licence authorises the Licensee to establish, install and use the Radio Equipment only within a 30km radius of a point indicated by the coordinate TQ 30235 80463 (latitude 51.5081 N, longitude -0.1248 W), as illustrated in Figure 1 below.]

[EXAMPLE 2: Figure 1]



Total route length

[Not applicable for Licences with a geographic scope of Great Britain (England, Scotland or Wales), or all of Northern Ireland]

4. The Licensee's total route length is [XX] miles.

SCHEDULE 3 – EMF Licence Conditions

Licence category: Spectrum Access FRMCS 1900-1910 MHz

Sites which are not shared with another licensee

1. The Licensee shall only establish, install, modify or use Relevant Radio Equipment if the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment do not exceed the basic restrictions³ in the relevant tables for general public exposure identified in the ICNIRP Guidelines⁴ in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

Sites which are shared with another licensee

2. In the case of a shared site where the Shared Site Exemption applies to the Licensee, the Licensee shall comply with paragraph 1 above.
3. In the case of a shared site where the Shared Site Exemption does not apply to the Licensee, the Licensee shall only establish, install, modify or use the Relevant Radio Equipment if:
 - i) the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment, together with
 - ii) the total electromagnetic field exposure levels produced by all other wireless telegraphy stations and wireless telegraphy apparatus operated by another licensee on the same site for which the Licensee can reasonably assume that a Shared Site Exemption does not apply,

do not exceed the basic restrictions⁵ in the relevant tables for general public exposure identified in the ICNIRP Guidelines⁶ in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

³ Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.

⁴ The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".

⁵ Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.

⁶ The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".

Emergency Situations

4. The obligations in paragraphs 1, 2 and 3 above will not apply if the Relevant Radio Equipment is being used for the purpose of seeking emergency assistance or reporting and responding to an emergency situation (in the vicinity of that situation) including for search and rescue activities and maritime emergency communications⁷.

Relationship with authorised transmission levels

5. The Licensee shall comply with paragraphs 1, 2 and 3 above notwithstanding the maximum transmission levels authorised in the Licence.

Records

6. The Licensee shall keep, or shall procure that a third party shall keep, and shall make available to Ofcom on request, records (including the type of records identified in Ofcom's "Guidance on EMF Compliance and Enforcement") that demonstrate how it has complied with paragraphs 1, 2 and 3 above when Relevant Radio Equipment is established, installed, modified or used.

Ofcom's "Guidance on EMF Compliance and Enforcement"

7. When evaluating its compliance with paragraphs 1, 2 and 3 above, the Licensee shall take into account Ofcom's "Guidance on EMF Compliance and Enforcement" that is in force at the relevant time.

⁷ Further information on emergency situations is set out in Ofcom's "Guidance on EMF Compliance and Enforcement".

Interpretation

8. In this schedule:

- a) “dBi” means the ratio in dB (decibel) when comparing the gain of the antenna to the gain of an isotropic antenna. An isotropic antenna is a theoretical antenna which radiates power uniformly in all directions;
- b) “EIRP” means equivalent isotropically radiated power which is the product of the power supplied to an antenna and the absolute or isotropic antenna gain in a given direction relative to an isotropic antenna;
- c) “ERP” means effective radiated power which is the product of the power supplied to an antenna and its gain in a given direction relative to a half-wave dipole;
- d) “general public” means any person who is not: (a) the Licensee, owner, operator or installer of the Relevant Radio Equipment; or (b) acting under a contract of employment or otherwise acting for purposes connected with their trade, business or profession or the performance by them of a public function;⁸
- e) “ICNIRP Guidelines” means the version of the Guidelines published by the International Commission on Non-Ionizing Radiation Protection for limiting exposure to electromagnetic fields which are identified in Ofcom’s “Guidance on EMF Compliance and Enforcement” that is in force at the relevant time.⁹
- f) “Licensee’s On-Site Radio Equipment” means the Relevant Radio Equipment and any other wireless telegraphy station(s) and wireless telegraphy apparatus on the same site which transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP.¹⁰
- g) “Relevant Radio Equipment” means all the Radio Equipment that is authorised by this Licence to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP.

⁸ There is pre-existing health and safety legislation which already requires employers to protect workers from exposure to electromagnetic fields (“EMF”) including the following legislation specifically relating to EMF (as amended from time to time): [The Control of Electromagnetic Fields at Work Regulations 2016](#), [The Control of Electromagnetic Fields at Work Regulations \(Northern Ireland\) 2016](#) and [The Merchant Shipping and Fishing Vessels \(Health and Safety at Work\) \(Electromagnetic Fields\) Regulations 2016](#).

⁹ Ofcom’s “Guidance on EMF Compliance and Enforcement” will initially require the Licensee to comply with the ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz), published in: Health Physics 74(4):494-522, dated April 1998 and available at: <https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf> (“1998 Guidelines”) or the ICNIRP Guidelines for limiting exposure to electromagnetic fields (100 KHz to 300 GHz), published in: Health Physics 118(5): 483–524; 2020 and available at: <https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf> (“2020 Guidelines”). However, once work on the relevant standards explaining the methodology for assessing compliance with the 2020 Guidelines has progressed sufficiently, Ofcom will publish a public consultation on updating its “Guidance on EMF Compliance and Enforcement” to explain that going forward Ofcom will be requiring the Licensee to comply with the 2020 Guidelines only. Following this public consultation, Ofcom will publish an updated version of Ofcom’s “Guidance on EMF Compliance and Enforcement” on its website. Ofcom will follow the same process for any subsequent versions of the ICNIRP Guidelines.

¹⁰ 10 Watts EIRP is equivalent to 6.1 Watts ERP. In linear units $EIRP (W) = 1.64 \times ERP (W)$; in decibels $EIRP (dB) = ERP (dB) + 2.15$. Ofcom’s “Guidance on EMF Compliance and Enforcement” explains how the Licensee can determine if wireless telegraphy station(s) or wireless telegraphy apparatus “transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP”.

- h) “Shared Site Exemption” means any of the following three situations apply on a shared site in relation to the Licensee’s or another licensee’s wireless telegraphy station(s) or wireless telegraphy apparatus that is authorised to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP:
- The first situation is that all of the licensee’s wireless telegraphy station(s) or wireless telegraphy apparatus on a shared site do not transmit at a combined total radiated power in any particular direction¹¹ that is higher than 100 Watts EIRP or 61 Watts ERP;¹²
 - The second situation is that the total electromagnetic field exposure levels produced by the licensee’s wireless telegraphy station(s) or wireless telegraphy apparatus in any area where a member of the general public is or can be expected to be present when transmissions are taking place is no more than 5% of the basic restrictions or 5% of the reference levels in the relevant tables for general public exposure identified in the ICNIRP Guidelines;¹³
 - The third situation is where the licensee’s wireless telegraphy station or wireless telegraphy apparatus has an antenna gain that is equal to or higher than 29 dBi and has a fixed beam;
- i) “shared site” means a site that is shared by the Licensee and at least one other licensee for the purposes of establishing, installing, modifying or using wireless telegraphy stations or wireless telegraphy apparatus;
- j) “site” means a physical structure, building, vehicle or moving platform;
- k) “wireless telegraphy apparatus” has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006; and
- l) “wireless telegraphy station” has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006.

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¹¹ For the purpose of this situation, the combined total radiated power is a simple sum of the radiated powers (in EIRP or ERP) of all of the licensee’s wireless telegraphy station(s) or wireless telegraphy apparatus on the shared site that transmits signals covering the same or overlapping areas.

¹² 100 Watts EIRP is equivalent to 61 Watts ERP.

¹³ The relevant tables for general public exposure are identified in Ofcom’s “Guidance on EMF Compliance and Enforcement”.