Office of Communications (Ofcom)
Wireless Telegraphy Act 2006

SPECTRUM ACCESS 800 MHz / 2.6 GHz LICENCE

This licence document replaces the version of the Licence issued by the Ofcom on 01 November 2021 to Vodafone Limited.

Licence no: **0943538**

Date of issue: **15 November 2022**

Fee payment date (from 1 March 2033): **1 March (annually)**

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

Vodafone Limited
(Company registration number 1471587)
("the Licensee")
The Connection
Newbury
Berkshire
RG14 2FN

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 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, or with the consent, of the Licensee;

(b) if there has been a breach of any of the terms of this Licence;

(c) in accordance with schedule 1 paragraph 8(5) of the Act;

(d) if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purpose 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;

(e) 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 30(3) of the Act[1];

(f) for reasons related to the management of the radio spectrum, provided that in such a case the power to revoke may only be exercised after at least five years' notice is given in writing (such notice not to be given before 1 March 2028);

(g) 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) Regulations 2012 ("the Regulations").

4. Ofcom may only revoke or vary this Licence by notification in writing to the Licensee and in accordance with schedule 1 paragraphs 6, 6A and 7 of the Act.

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 Act[2].

Changes to Licensee details

6. The Licensee shall give prior notice to Ofcom in writing of any changes to the Licensee's name and/or address as recorded in paragraph 1 of this Licence.

Fees

7. From 1 March 2033, 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 on or before the fee payment date shown above, or on or before such dates as are notified in writing to the Licensee.

8. The Licensee shall also pay interest to Ofcom on any amount which is due to Ofcom 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.

9. If the Licence is surrendered, revoked or varied, no refund, whether in whole or in part, of any amount which is due under the terms of this Licence, payable in accordance with the Regulations, 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.

[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.

Radio Equipment Use

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

11. The Licensee shall 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.

12. The Licensee must ensure that all Radio Equipment is established, installed, modified and used only in accordance with the provisions specified in schedule 4 (EMF Licence Condition) of this Licence.

Access and Inspection

13. 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, 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. 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 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.

15. 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

16. Subject to the requirements of any coordination procedures notified to the Licensee pursuant to schedules 1, 2 and/or 3 to this Licence, the Licensee is authorised to establish, install and use the Radio Equipment in the United Kingdom. For the avoidance of doubt, the United Kingdom includes the United Kingdom territorial sea (measured in accordance with section 1 of the Territorial Sea Act 1987) and does not include the Channel Islands or the Isle of Man.

Interpretation

17. 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 "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 schedules 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: 0943538

Schedule Date: **15 November 2022**

Licence category: **Spectrum Access Licence (790 – 862 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 under this schedule.

Interface Requirements for the Radio Equipment

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

   IR 2090: Terrestrial systems capable of providing electronic communications services in the 800 MHz band

Special conditions relating to the Radio Equipment

3.

(a) Subject to paragraph 3(b) 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:

i) postal address (including post code);

ii) National Grid Reference, to at least 1 metre resolution;

iii) antenna height (above ground level), type, and boresight bearing east of true north (if applicable); and

iv) radio frequencies which the Radio Equipment uses

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

(b) The conditions relating to the keeping of records contained in sub-paragraphs 3(a)(ii) and (iii) of this schedule shall not apply in respect of femtocell equipment and smart/intelligent low power repeater equipment.

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

(d) The Licensee shall provide to:

i) Ofcom;

ii) the entity established in accordance with paragraphs 2.1 – 2.2 of the "*Notice of DTT interference mitigation procedures required under spectrum access licences for the 800 MHz band"* notified to it by Ofcom in accordance with paragraph 4 of this schedule; and/or

iii) the Oversight Board

in such manner and at such times as they may reasonably require, such documents or other information as they may require for the purposes of taking steps to mitigate interference to users of the electromagnetic spectrum in the 470-790 MHz band, or to make recommendations to Ofcom or Government with respect to such steps being taken.

Co-ordination at frequency and geographical boundaries and compliance with other procedures relating to interference

4. The Licensee shall ensure that the Radio Equipment is operated in compliance with such co-ordination procedures as may be notified to the Licensee by Ofcom from time to time. The Licensee shall also ensure that it complies with any other procedures relating to the mitigation of interference as may be notified to the Licensee by Ofcom from time to time.

International cross-border coordination

5. 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

6. Subject to the emissions permitted under paragraph 8 of this schedule, the Radio Equipment may only transmit within the following frequency bands (the "Permitted Frequency Blocks"):

Downlink frequencies	Uplink frequencies
801 – 811 MHz	**842 – 852** MHz

Maximum power within the Permitted Frequency Blocks

7. The power transmitted in the Permitted Frequency Blocks shall not exceed:

(a) Downlink frequencies

	Maximum mean power dBm/(5 MHz) EIRP per antenna
Radio Equipment*	64

* For femtocell base stations, power control must be applied to minimise interference to adjacent channels.

(b) Uplink frequencies[3]

Radio Equipment	Maximum mean power
Fixed or installed Radio Equipment	23dBm EIRP*
Mobile or nomadic Radio Equipment	23dBm TRP*

* The maximum mean power relates to the EIRP or TRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.

Maximum power outside the Permitted Frequency Blocks

8. For transmissions on the downlink frequencies, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks, but within 791 – 821 MHz, shall not exceed:

Frequency range	Maximum mean EIRP per antenna	Measurement bandwidth
-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	22 dBm*	5 MHz
-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	18 dBm*	5 MHz
Out of block baseline power limit (BS) < -10 MHz offset from lower block edge > 10 MHz offset from upper block edge	11 dBm*	1 MHz

* These limits apply to all Radio Equipment installed after 01 November 2021.

9. In addition, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the downlink frequencies of the Permitted Frequency Blocks shall not exceed the higher (least stringent) of (a) the baseline requirements and (b) the transitional requirements for that frequency.

(a) Baseline requirements

Frequency range	In-block EIRP, P, dBm/(10 MHz)**	Maximum mean EIRP in frequency range	Measurement bandwidth
470 to 733 MHz	P ≥ 59	0 dBm*	8 MHz
	36 ≤ P < 59	(P−59) dBm*	8 MHz
	P < 36	−23 dBm*	8 MHz

* The maximum EIRP relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.
**This is the in-block EIRP measured in a bandwidth of 10 MHz.

[3] Consumer user equipment will be authorised by means of a licence exemption under section 8 of the Wireless Telegraphy Act 2006

Frequency range	Maximum mean EIRP	Measurement bandwidth
733 to 788 MHz	16 dBm per antenna	5 MHz
788 to 790 MHz	12 dBm per antenna	2 MHz
790 to 791 MHz	17.4 dBm per antenna**	1 MHz
821 to 832 MHz	15 dBm per antenna**	1 MHz
832 to 862 MHz	−49.5 dBm*	5 MHz

* The maximum EIRP relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.
** Subject to the further limits set out in paragraph 9(b), these limits apply to all Radio Equipment installed after 01 November 2021.

(b) Transitional requirements

For a block with a lower edge of 791 MHz

Frequency range	Maximum mean EIRP per antenna	Measurement bandwidth
778 – 783 MHz	17 dBm	5 MHz
783 – 788 MHz	19 dBm	5 MHz
788 – 790 MHz	19.2 dBm	2 MHz
790 – 791 MHz	16.2 dBm*	1 MHz

For a block with a lower edge of 796 MHz

Frequency range	Maximum mean EIRP per antenna	Measurement bandwidth
783 – 788 MHz	17 dBm	5 MHz
788 – 790 MHz	14.2 dBm	2 MHz
790 – 791 MHz	11.2 dBm*	1 MHz

* Subject to the further limits set out in paragraph 9(a), these limits apply to all Radio Equipment installed after 01 November 2021.

Interpretation of terms in this schedule

10. In this schedule:

(a) "dBm" means the power level in decibels (logarithmic scale) referenced against 1milliwatt (i.e. a value of 0 dBm is 1 milliwatt);

(b) "EIRP" 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);

(c) "femtocell" means Radio Equipment transmitting on the downlink frequencies, which operates at a power not exceeding 24 dBm EIRP per carrier, and which is or will be used only by and under the control of the Licensee, following the establishment of a telecommunications link between the femtocell and a network of the Licensee;

(d) "Fixed or installed" means used or installed at specific fixed points;

(e) "IR" means a United Kingdom Radio Interface Requirement published 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;

(f) "lower block edge" means, in relation to each Permitted Frequency Block, the lowest frequency in that Permitted Frequency Block;

(g) "measurement bandwidth" means the size of an individual spectrum segment within the specified frequency range that is used to measure compliance with the specified power limit;

(h) "mobile or nomadic" means intended to be used while in motion or during halts at unspecified points;

(i) "Oversight Board" has the meaning given to it in the "Notice of DTT interference mitigation procedures required under spectrum access licences for the 800 MHz band" notified to the Licensee under paragraph 4 of this schedule;

(j) "Permitted Frequency Blocks" has the meaning given to it in paragraph 6 of this schedule;

(k) "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:

- The Licensee has ultimate control of the repeater, i.e. each individual repeater can be disabled remotely by the Licensee;
- The repeater operates only on the Licensee's frequencies and with their valid Public Land Mobile Network Identifier;
- Must not cause undue interference to other spectrum users; and
- The repeater only transmits on the uplink frequencies when actively carrying a call (voice, video or data) or signalling from serviced handsets.

(l) "TRP" means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere;

(m) "upper block edge" means, in relation to each Permitted Frequency Block, the highest frequency in that Permitted Frequency Block.

SCHEDULE 2 TO LICENCE NUMBER: 0943538

Schedule Date: **15 November 2022**

Licence category: **Spectrum Access 2500 MHz – 2690 MHz (Paired Spectrum)**

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 under this schedule.

Interface Requirements for the Radio Equipment

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

   IR 2072: Terrestrial systems capable of providing electronic communications services in the band 2500 to 2690 MHz

Special conditions relating to the Radio Equipment

3.

(a) Subject to paragraph 3(b) 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:

i) postal address (including post code);

ii) National Grid Reference, to at least 10 metre resolution;

iii) antenna height (above ground level), type, and boresight bearing east of true north (if applicable);

iv) radio frequencies which the Radio Equipment uses;

v) Transmitted power expressed in dBm / 5 MHz EIRP per antenna for non-AAS Radio Equipment; and

vi) Transmitted power expressed in dBm / 5 MHz TRP per cell for AAS Radio Equipment;

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

(b) The conditions relating to the keeping of records contained in sub-paragraphs 3(a)(ii) and (iii) of this schedule shall not apply in respect of femtocell equipment and smart/intelligent low power repeater equipment.

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

Co-ordination at frequency and geographical boundaries

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

International cross-border coordination

5. 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

6. Subject to the emissions permitted under paragraph 8 of this schedule, the Radio Equipment may only transmit within the following frequency bands (the "Permitted Frequency Blocks"):

Downlink frequencies	**Uplink frequencies**
2620 – 2640 MHz	**2500 – 2520** MHz

Maximum power within the Permitted Frequency Blocks

7. Subject to any more restrictive limitations imposed by the coordination requirements notified by Ofcom in accordance with paragraphs 4 and 5 of this schedule, the power transmitted in the Permitted Frequency Blocks shall not exceed:

(a) Downlink frequencies

	Maximum mean Power
Non- AAS Radio Equipment	61 dBm / (5 MHz) EIRP per antenna
AAS Radio Equipment	46 dBm / (5 MHz) TRP per cell

(b) Uplink frequencies[4]

Radio Equipment	**Maximum mean power**
Mobile or nomadic Radio Equipment	31 dBm / (5 MHz) TRP
Fixed or installed Radio Equipment	35 dBm / (5 MHz) EIRP

[4] Consumer use equipment will be authorised by means of a licence exemption under section 8 of the Wireless Telegraphy Act 2006

Maximum power outside the Permitted Frequency Blocks

8. For transmissions on the downlink frequencies, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks shall not exceed the higher (least stringent) of (a) the baseline requirements and (b) the block specific requirements for that frequency.

(a) Baseline requirements

Frequency range	Maximum mean EIRP per antenna for non-AAS Radio Equipment	Maximum mean TRP per cell for AAS Radio Equipment	Measurement bandwidth
2500 to 2615 MHz	−45 dBm	-52 dBm	1 MHz
2615 to 2700 MHz	4 dBm	5 dBm	1 MHz
2700 to 3100 MHz	−45 dBm	-52 dBm	1 MHz

(b) Block-specific requirements

Frequency range	Maximum mean EIRP per antenna for non-AAS Radio Equipment	Maximum mean TRP per cell for AAS Radio Equipment	Measurement bandwidth
Start of band (2500 MHz) to −5 MHz from lower block edge	Baseline requirement level		
−5 MHz to 0 MHz from lower block edge	16 dBm	16 dBm	5 MHz
0 MHz to 5 MHz from upper block edge	16 dBm	16 dBm	5 MHz
5 MHz from upper block edge to end of band (2690 MHz)	Baseline requirement level		

Interpretation of terms in this schedule

9. 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) "dBm" means the power level in decibels (logarithmic scale) referenced against 1milliwatt (i.e. a value of 0 dBm is 1 milliwatt);

(c) "EIRP" 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);

(d) "femtocell" means Radio Equipment transmitting on the downlink frequencies, which operates at a power not exceeding 24 dBm EIRP per carrier, and which is or will be used only by and under the control of the Licensee, following the establishment of a telecommunications link between the femtocell and a network of the Licensee;

(e) "Fixed or installed" means used or installed at specific fixed points;

(f) "IR" means a United Kingdom Radio Interface Requirement published 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) "lower block edge" means, in relation to each Permitted Frequency Block, the lowest frequency in that Permitted Frequency Block;

(h) "measurement bandwidth" means the size of an individual spectrum segment within the specified frequency range that is used to measure compliance with the specified power limit;

(i) "mobile or nomadic" means intended to be used while in motion or during halts at unspecified points;

(j) "non-AAS" means a piece of Radio Equipment which is not an AAS;

(k) "per antenna" means per radiating unit/component (irrespective of the number of radiating elements that make up that unit/component);

(l) "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;

(m) "Permitted Frequency Blocks" has the meaning given to it in paragraph 6 of this schedule;

(n) "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:

- The Licensee has ultimate control of the repeater, i.e. each individual repeater can be disabled remotely by the Licensee;
- The repeater operates only on the Licensee's frequencies and with their valid Public Land Mobile Network Identifier;
- Must not cause undue interference to other spectrum users; and
- The repeater only transmits on the uplink frequencies when actively carrying a call (voice, video or data) or signalling from serviced handsets;

(o) "TRP" means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere; and

(p) "upper block edge" means, in relation to each Permitted Frequency Block, the highest frequency in that Permitted Frequency Block.

Ofcom

SCHEDULE 3 TO LICENCE NUMBER: 0943538

Schedule Date: **15 November 2022**

Licence category: **Spectrum Access 2500 MHz – 2690 MHz (Unpaired Spectrum)**

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 under this schedule.

Interface Requirements for the Radio Equipment

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

   IR 2072: Terrestrial systems capable of providing electronic communications services in the band 2500 to 2690 MHz

Special conditions relating to the Radio Equipment

3.

(a) Subject to paragraph 3(b) 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:

i) postal address (including post code);

ii) National Grid Reference, to at least 10 metre resolution;

iii) antenna height (above ground level), type, and boresight bearing east of true north (if applicable);

iv) radio frequencies which the Radio Equipment uses;

v) Transmitted power expressed in dBm / 5 MHz EIRP per antenna for non-AAS Radio Equipment; and

vi) Transmitted power expressed in dBm / 5 MHz TRP per cell for AAS Radio Equipment;

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

(b) The conditions relating to the keeping of records contained in sub-paragraphs 3(a)(ii) and (iii) of this schedule shall not apply in respect of femtocell equipment and smart/intelligent low power repeater equipment.

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

Co-ordination at frequency and geographical boundaries

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

International cross-border coordination

5. 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

6. Subject to the emissions permitted under paragraph 8 of this schedule, the Radio Equipment may only transmit within the following frequency bands (the "Permitted Frequency Blocks"):

"Unrestricted frequencies" (uplink and downlink):	**2575 – 2595** MHz
"Restricted frequencies" (uplink and downlink):	**2570 – 2575** MHz

Maximum power within the Permitted Frequency Blocks

7. For downlink transmissions, the power transmitted in the Permitted Frequency Blocks shall not exceed:

	Maximum EIRP per antenna for non-AAS Radio Equipment	**Maximum TRP per cell for AAS Radio Equipment**
Unrestricted frequencies	61dBm / (5 MHz) EIRP	46dBm / (5 MHz)
Restricted frequencies	25dBm / (5 MHz) EIRP	22dBm / (5 MHz)

For uplink transmissions, the power transmitted in the Permitted Frequency Blocks shall not exceed[5]:

Radio Equipment	**Maximum mean power**
Mobile or nomadic Radio Equipment	31 dBm / (5 MHz) TRP
Fixed or installed Radio Equipment	35 dBm / (5 MHz) EIRP

[5] Consumer user equipment will be authorised by means of a licence exemption under section 8 of the Wireless Telegraphy Act 2006

Maximum power outside the Permitted Frequency Blocks

Unrestricted frequencies

8. In the absence of bilateral or multilateral agreements which have been notified to Ofcom specifying alternative arrangements between the Licensee and any other Spectrum Access licensees in the 2570-2620 MHz sub-band, the Licensee must ensure that when transmitting on the unrestricted frequencies set out in this schedule transmissions must fall within the limits of Frame Structure A.

9. For downlink transmissions on unrestricted frequencies, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks shall not exceed the higher (least stringent) of (a) the baseline requirements and (b) the block specific requirements.

(a) Baseline requirements

Frequency range	Maximum mean EIRP per antenna for non-AAS Radio Equipment	Maximum mean TRP per cell for AAS Radio Equipment	Measurement bandwidth
2500 to 2570 MHz	−45 dBm	-52 dBm	1 MHz
2570 to 2700 MHz	4 dBm	5 dBm	1 MHz
2700 to 3100 MHz	−45 dBm	-52 dBm	1 MHz

(b) Block-specific requirements

Frequency range	Maximum mean EIRP per antenna for non-AAS Radio Equipment	Maximum mean TRP per cell for AAS Radio Equipment	Measurement bandwidth
Start of band (2500 MHz) to −5 MHz from lower boundary of unrestricted frequencies	Baseline requirement level		
−5 MHz to 0 MHz from lower boundary of unrestricted frequencies	16 dBm	16 dBm	5 MHz
0 MHz to 5 MHz from upper boundary of unrestricted frequencies	16 dBm	16 dBm	5 MHz
5 MHz from upper boundary of unrestricted frequencies to end of band (2690 MHz)	Baseline requirement level		

10. Frame Structure A means that:

(a) transmissions from the Licensee's base stations have a frame structure as shown in Figure 1. Timeslots (or subframes) 0, 2 to 5 and 7 to 9 must be allocated to Downlink (D) or Uplink (U) transmissions as indicated or may be left with no transmissions;

(b) the Licensee must ensure that the special subframes (S) in timeslots 1 and 6 have a structure that is compatible with TD-LTE special subframe configuration 6, also known as 9:3:2 (DwPTS: GP: UpPTS). For the avoidance of doubt, a special subframe structure is compatible where there are no uplink transmissions within the downlink pilot timeslot (DwPTS) or guard period (GP) and no downlink transmissions within the uplink pilot timeslot (UpPTS) or guard period (GP);

(c) timeslots must have a duration of 1 millisecond;

(d) the Licensee shall ensure that frames start at a common reference time so that all licensees' frames are aligned and transmissions synchronised;

Note: TD-LTE frame configuration 2 (3:1) is compatible with Frame Structure A, as are some 5G NR frame configurations. Other technologies are permitted provided that the requirements of 10(a) to 10(d) are met.

Figure 1: Frame Structure A

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
3:1	D	S	U	D	D	D	S	U	D	D

11. When transmitting on unrestricted frequencies, the Licensee is not required to comply with the frame structure requirements set out in paragraphs 9 and 10 for:

i) Indoor Domestic Small Cells; or

ii) Indoor Non-domestic Small Cells, except where another licensee demonstrates that they are suffering harmful interference as a result.

12. When transmitting on unrestricted frequencies, if another licensee demonstrates that they are suffering undue interference as a result of an Indoor Non-domestic Small Cell, the Indoor Non-domestic Small Cell must comply with the requirements set out in paragraphs 9 and 10 above.

Restricted frequencies

13. For downlink transmissions on restricted frequencies, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks shall not exceed the higher (least stringent) of (a) the baseline requirements and (if applicable) (b) the alternative block-specific requirements:

(a) Baseline requirements

Frequency range	Maximum mean EIRP per antenna for non-AAS Radio Equipment	Maximum mean TRP per cell for AAS Radio Equipment	Measurement bandwidth
2500 to 2615 MHz	−45 dBm	-52 dBm	1 MHz
2615 to 2700 MHz	4 dBm	5 dBm	1 MHz
2700 to 3100 MHz	−45 dBm	-52 dBm	1 MHz

(b) Alternative block-specific requirements

The following block-specific requirements apply to non-AAS base stations with outdoor antennas meeting the conditions in paragraph 9, and to non-AAS base stations with indoor antennas, subject to the "*Notice of coordination procedure for the licences covering the 2.6 GHz band – Deployment of mobile electronic communication networks in unpaired restricted blocks and in spectrum adjacent to unpaired restricted blocks*" notified by Ofcom to the Licensee:

Frequency range	Maximum mean EIRP per antenna for non-AAS Radio Equipment	Measurement bandwidth
Start of band (2500 MHz) to −5 MHz from lower boundary of restricted frequencies	−22 dBm	1 MHz
−5 MHz to 0 MHz from lower boundary of restricted frequencies	−6 dBm	5 MHz
0 MHz to 5 MHz from upper boundary of restricted frequencies	−6 dBm	5 MHz
5 MHz from upper boundary of restricted frequencies to end of band (2690 MHz)	−22 dBm	1 MHz

If the Licensee wishes to deploy AAS base stations with outdoor antennas meeting the conditions in paragraph 9 or AAS base stations with indoor antennas, the Licensee must demonstrate compliance with the EIRP limits in the table above and will be subject to the "Notice of coordination procedure for the licences covering the 2.6 GHz band – Deployment of mobile electronic communication networks in unpaired restricted blocks and in spectrum adjacent to unpaired restricted blocks" notified by Ofcom to the Licensee.

Antenna height limit for base stations using alternative block-specific requirements

14. The highest point of outdoor antenna systems of base stations using the alternative block-specific requirements shall be no more than 12m above ground level.

Interpretation of terms in this schedule

15. 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) "dBm" means the power level in decibels (logarithmic scale) referenced against 1milliwatt (i.e. a value of 0 dBm is 1 milliwatt);

(c) "downlink transmission" means transmission from a base station to a terminal station;

(d) "EIRP" 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) "femtocell" means Radio Equipment transmitting on the downlink frequencies, which operates at a power not exceeding 24 dBm EIRP per carrier, and which is or will be used only by and under the control of the Licensee, following the establishment of a telecommunications link between the femtocell and a network of the Licensee;

(f) "Fixed or installed" means used or installed at specific fixed points;

(g) "Indoor" means a location inside a building or place in which the shielding will typically provide the necessary attenuation to protect wireless telegraphy against harmful interference;

(h) "Indoor Domestic Small Cell" means a base station with an EIRP of less than or equal to 24dBm per 20 MHz carrier that is located within a residential property;

(i) "Indoor Non-domestic Small Cell" means a base station with an EIRP of less than or equal to 24dBm per 20 MHz carrier that is located indoors but not within a residential property;

(j) "IR" means a United Kingdom Radio Interface Requirement published 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;

(k) "measurement bandwidth" means the size of an individual spectrum segment within the specified frequency range that is used to measure compliance with the specified power limit;

(l) "mobile or nomadic" means intended to be used while in motion or during halts at unspecified points;

(m) "non-AAS" means a piece of Radio Equipment which is not an AAS;

(n) "per antenna" means per radiating unit/component (irrespective of the number of radiating elements that make up that unit/component);

(o) "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;

(p) "Permitted Frequency Blocks" has the meaning given to it in paragraph 6 of this this schedule;

(q) "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:

- The Licensee has ultimate control of the repeater, i.e. each individual repeater can be disabled remotely by the Licensee;
- The repeater operates only on the Licensee's frequencies and with their valid Public Land Mobile Network Identifier;
- Must not cause undue interference to other spectrum users; and
- The repeater only transmits on the uplink frequencies when actively carrying a call (voice, video or data) or signalling from serviced handsets.

(r) "TRP" means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere; and

(s) "uplink transmission" means transmission from a terminal station to a base station.

SCHEDULE 4 TO LICENCE NUMBER: 0943538

EMF Licence Condition

Schedule Date: **15 November 2022**

Licence category: **Spectrum Access 800 MHz / 2.6 GHz**

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 restrictions[6] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[7] 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:

   (a) the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment, together with

   (b) 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 restrictions[8] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[9] in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

[6] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[7] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".
[8] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[9] 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 communications[10].

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.

[10] Further information on emergency situations in 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;[11]

(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.[12]

(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.[13]

[11] 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.

[12] 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.

[13] 10 Watts EIRP is equivalent to 6.1 Watts ERP. In linear units EIRP (W) = 1.64 x ERP (W); in decibels EIRP (dB) = ERP (dB) + 2.15. Ofcom's "Guidance on EMF Compliance and Enforcement"

(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.

(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 direction[14] that is higher than 100 Watts EIRP or 61 Watts ERP;[15]
- 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;[16]
- 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.

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".

[14] 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.

[15] 100 Watts EIRP is equivalent to 61 Watts ERP.

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