

UK Interface Requirement 2028

Amateur Radio Licences – Foundation, Intermediate and Full

Publication date: Jan 2007
98/34/EC Notification number: 2006/511/UK

Contents

Section		Page
1	References	3
2	Foreword	4
3	Minimum requirements for operation in the UK	5
4	Additional performance parameters	7
5	Annex A	8
	<i>Schedule 1</i>	
	<i>Foundation licence parameters (Table A)</i>	9
	<i>Intermediate licence parameters (Table B)</i>	10
	<i>Full licence parameters (Table C)</i>	12
	<i>Schedule 2</i>	
	<i>Additional restrictions which apply to the Unattended Operation of Beacons</i>	14
6	Annex B (Informative)	16
7	Contact details	17
8	Document history	18

Section 1

References

- 1.1 **ETSI - EN 301 783-1 V1.1.1 (2000-09)** - Electromagnetic compatibility and Radio Spectrum Matters (ERM); Land Mobile Service; Commercially available amateur radio equipment; Part 1: Technical characteristics and methods of measurement.
- 1.2 **ETSI - EN 301 783-2 V1.1.1 (2000-09)** - Electromagnetic compatibility and Radio Spectrum Matters (ERM); Land Mobile Service; Commercially available amateur radio equipment; Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive.
- 1.3 **ETSI – EN 301 489-1 V1.6.1** - Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
- 1.4 **ETSI - EN 301 489-15 V1.2.1 (2002-08)** - Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 15: Specific conditions for commercially available amateur radio equipment.
- 1.5 **RSGB Yearbook 2007** Published by the Radio Society of Great Britain (Informative - for RSGB recommended Operating Band Plans)

Section 2

Foreword

- 2.1 The Radio Equipment and Telecommunications Terminal Equipment Directive 99/5/EC (R&TTE Directive) was implemented in the United Kingdom (UK) on the 8 April 2000 by The Radio Equipment and Telecommunications Terminal Equipment Regulations 2000, Statutory Instrument 2000 No. 730. In accordance with Articles 4.1 and 7.2 of Directive 1999/5/EC, this UK Interface Requirement contains the requirements for the licensing and use of Amateur Radio in the specified frequency bands.
- 2.2 Nothing in this UK Radio Interface Requirement shall preclude the need for equipment to comply with Directive 1999/5/EC.
- 2.3 It is required by the Wireless Telegraphy Act 1949 that no radio equipment is installed or used in the UK except under the authority of a licence granted by or otherwise exempted by regulations made by Ofcom. It is a condition of such a licence or exemption regulations as appropriate that, in order to be installed or used in the UK, the equipment must meet the minimum requirements specified in this UK Interface Requirement for the stated equipment types and for the stated frequency bands. Nothing in this UK Interface Requirement shall preclude equipment from being placed on the market in the UK that complies with the 'essential requirements' specified in Directive 1999/5/EC.
- 2.4 The requirements given in the main body of this UK Radio Interface Requirement will apply to Amateur Radio licences.
- 2.5 This UK Radio Interface Requirement will be revised as necessary, for example to follow:
 - i) current technology developments for reasons related to the effective and appropriate use of the spectrum in particular maximising spectrum utilisation; and
 - ii) changes to the available spectrum allocated for Amateur Radio.
- 2.6 All UK Radio Interface Requirements notified under Directive 1998/34/EC will be published and will be made available free of charge from the Ofcom web-site at <http://www.ofcom.org.uk>
- 2.7 Further information on this UK Radio Interface Requirement can be obtained from the technical enquiry contact given at the back of this document.

Section 3

Minimum requirements for operation within the UK

- 3.1 The minimum requirements in this document are made for reasons related to the effective and appropriate use of the radio spectrum, in particular maximising spectrum utilisation.
- 3.2 This UK Radio Interface Requirement gives a high level description of how the spectrum in the UK is used for Amateur Radio. It does not prescribe technical interpretation of the 'essential requirements' of Directive 1999/5/EC.
- 3.3 This UK Radio Interface Requirement therefore stipulates the necessary equipment parameters for the licensing of Amateur Radio in the UK. Table 3.1 contains the relevant equipment parameters. These taken together with the 'essential requirements' detailed in Article 3.2 of Directive 1999/5/EC constitute the minimum requirements for the installation and use of Amateur Radio within the UK. Nothing in this UK Interface Requirement shall preclude equipment from being placed on the market in the UK that complies with the 'essential requirements' specified in Directive 1999/5/EC.
- 3.4 The technical parameters specified in the UK Radio Interface Requirement are applied to achieve the desired level of compatibility within the Amateur Radio bands and with other radiocommunications services, whilst promoting enterprise, innovation and competition.
- 3.5 This UK Radio Interface requirement provides the necessary technical information which facilitates access to the Amateur Radio spectrum by making clear the assumptions that are made in planning the use of the Amateur Radio spectrum in the UK. It is not the intention of this UK Radio Interface Requirement to duplicate or impose any additional 'essential requirements' of the Directive 1999/5/EC on products. Any specified parameters within this document are for the purpose of identifying product options and not as a national de facto product requirement

Table 3.1: Minimum requirements for the use of Amateur Radio

Mandatory Elements (1-9)		
1	Frequency band (or bands)	See Annex A
2	Radio service	See Annex A
3	Application	See Annex A
4	Channelling modulation	See Annex A
5	Transmit power limit	See Annex A
6	Channel occupation rules	See Annex A
7	Duplex type/separation	See Annex A
8	Licensing Regime	Individual licence { (Full Licence, Full (Reciprocal) Licence, Full (Temporary Reciprocal) Licence, Full (Club) Licence) } as appropriate.
9	Additional essential requirements	N/A
Informative Elements (10-13)		
10	Frequency planning assumptions	EN 301 783 ^{1.1} EN 301 783 ^{1.2} EN 301 489 ^{1.3} EN 301 489 ^{1.4}
11	References	EN 301 783 ^{1.1} EN 301 783 ^{1.2} EN 301 489 ^{1.3} EN 301 489 ^{1.4} RSGB Yearbook ^{1.5} 2007 pages 180–185 (informative - for RSGB recommended operating Band Plans www.rsgb.org.uk/bandplans/bandplans.pdf www.rsgb-spectrumforum.org.uk)
12	Remarks	N/A.
13	Notification Number	2006/511/UK

Section 4

Additional performance parameters

(Informative)

None specified

Section 5

Annex A (Normative)

Transmission is permitted in the frequency bands in accordance with the conditions in the tables listed below subject to the operator holding a relevant certificate(s) of competence.

Notes

Note 1: dBW is the power level in dB relative to one Watt.

Peak envelope power is the average power supplied to the antenna by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions.

Effective radiated power (e.r.p.) (in a given direction) is the product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

Note 2: ISM is an abbreviation for industrial, scientific and medical applications.

Schedule 1

Table A

Foundation Licence Parameters

Frequency Bands (in MHz)	Status of allocations in UK to the Amateur Service	Status of allocations in UK to the Amateur Satellite Service	Maximum Peak Envelope Power level in Watts (and dB relative to 1 Watt)
0.1357-0.1378	Secondary. Available on the basis of non-interference to other services inside or outside the UK.	Not allocated	1W (0 dBW) e.r.p.
1.810-1.830	Primary. Available on the basis of non-interference to other services outside the UK.	Not allocated	10W (10 dBW)
1.830-1.850	Primary	Not allocated	10W (10 dBW)
1.850-2.000	Secondary. Available on the basis of non-interference to other services inside or outside the UK.	Not allocated	10W (10 dBW)
3.500-3.800	Primary. Shared with other services	Not allocated	10W (10 dBW)
7.000-7.100	Primary	Primary	10W (10 dBW)
7.100-7.200	Secondary. Available on the basis of non-interference to other services inside or outside the UK.	Not allocated	10W (10 dBW)
10.100-10.150	Secondary	Not allocated	10W (10 dBW)
14.000-14.250	Primary	Primary	10W (10 dBW)
14.250-14.350	Primary	Not allocated	10W (10 dBW)
18.068-18.168	Primary	Primary	10W (10 dBW)
21.000-21.450	Primary	Primary	10W (10 dBW)
24.890-24.990	Primary	Primary	10W (10 dBW)
28.000-29.700	Primary	Primary	10W (10 dBW)
50.00-51.00	Primary. Available on the basis of non-interference to other services outside the UK	Not allocated	10W (10 dBW)
51.00-52.00	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	10W (10 dBW)
70.00-70.50	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	10W (10 dBW)
144.0-146.0	Primary	Primary	10W (10 dBW)
430.0-431.0	Secondary	Not allocated	10W (10 dBW) e.r.p.
431.0-432.0	Secondary. Not available for use within 100km radius of Charing Cross, London (51°30'30"N, 00°07'24"W)	Not allocated	10W (10 dBW) e.r.p.
432.0-435.0	Secondary	Not allocated	10W (10 dBW)
435.0-438.0	Secondary	Secondary	10W (10 dBW)
438.0-440.0	Secondary	Not allocated	10W (10 dBW)
10000-10125	Secondary	Not allocated	1W (0 dBW)
10225-10450	Secondary	Not allocated	1W (0 dBW)
10450-10475	Secondary	Secondary	1W (0 dBW)
10475-10500	Not allocated	Secondary	1W (0 dBW)

Table B
Intermediate Licence Parameters

Frequency Bands (in MHz)	Status of allocations in UK to the Amateur Service	Status of allocations in UK to the Amateur Satellite Service	Maximum Peak Envelope Power level in Watts (and dB relative to 1 Watt)
0.1357-0.1378	Secondary. Available on the basis of non-interference to other services inside or outside the UK.	Not allocated	1W (0 dBW) e.r.p.
1.810-1.830	Primary. Available on the basis of non-interference to other services outside the UK	Not allocated	50W (17 dBW)
1.830-1.850	Primary	Not allocated	50W (17 dBW)
1.850-2.000	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	32W (15 dBW)
3.500-3.800	Primary. Shared with other services	Not allocated	50W (17 dBW)
7.000-7.100	Primary	Primary	50W (17 dBW)
7.100-7.200	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	50W (17 dBW)
10.100-10.150	Secondary	Not allocated	50W (17 dBW)
14.000-14.250	Primary	Primary	50W (17 dBW)
14.250-14.350	Primary	Not allocated	50W (17 dBW)
18.068-18.168	Primary	Primary	50W (17 dBW)
21.000-21.450	Primary	Primary	50W (17 dBW)
24.890-24.990	Primary	Primary	50W (17 dBW)
28.000-29.700	Primary	Primary	50W (17 dBW)
50.00-51.00	Primary. Available on the basis of non-interference to other services outside the UK	Not allocated	50W (17 dBW)
51.00-52.00	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	50W (17 dBW)
70.00-70.50	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	50W (17 dBW)
144.0-146.0	Primary	Primary	50W (17 dBW)
430.0-431.0	Secondary	Not allocated	40W (16 dBW) e.r.p.
431.0-432.0	Secondary. Not available for use within 100km radius of Charing Cross, London (51°30'30"N, 00°07'24"W)	Not allocated	40W (16 dBW) e.r.p.
432.0-435.0	Secondary	Not allocated	50W (17 dBW)
435.0-438.0	Secondary	Secondary	50W (17 dBW)
438.0-440.0	Secondary	Not allocated	50W (17 dBW)

... continued

Intermediate Licence Parameters (continued)

Frequency Bands (in MHz)	Status of allocations in UK to the Amateur Service	Status of allocations in UK to the Amateur Satellite Service	Maximum Peak Envelope Power level in Watts (and dB relative to 1 Watt)
1240-1260	Secondary	Not allocated	50W (17 dBW)
1260-1270	Secondary	Secondary. Earth to space only	50W (17 dBW)
1270-1325	Secondary	Not allocated	50W (17 dBW)
2310-2400	Secondary	Not allocated	50W (17 dBW)
2400-2450	Secondary. Users must accept interference from ISM users.	Secondary. Users must accept interference from ISM users.	50W (17 dBW)
3400-3475	Secondary	Not allocated	50W (17 dBW)
5650-5670	Secondary	Secondary. Earth to space only	50W (17 dBW)
5670-5680	Secondary	Not allocated	50W (17 dBW)
5755-5765	Secondary. Users must accept interference from ISM users.	Not allocated	50W (17 dBW)
5820-5830	Secondary. Users must accept interference from ISM users.	Not allocated	50W (17 dBW)
5830-5850	Secondary. Users must accept interference from ISM users.	Secondary. Users must accept interference from ISM users. Space to Earth only.	50W (17 dBW)
10000-10125	Secondary	Not allocated	50W (17 dBW)
10225-10450	Secondary	Not allocated	50W (17 dBW)
10450-10475	Secondary	Secondary	50W (17 dBW)
10475-10500	Not allocated	Secondary	50W (17 dBW)
24000-24050	Primary. Users must accept interference from ISM users	Primary. Users must accept interference from ISM users	50W (17 dBW)
24050-24150	Secondary. May only be used with the written consent of Ofcom. Users must accept interference from ISM users	Not allocated	50W (17 dBW)
24150-24250	Secondary	Not allocated	50W (17 dBW)
47000-47200	Primary	Primary	50W (17 dBW)
75500-75875	Secondary	Secondary	50W (17 dBW)
75875-76000	Primary	Primary	50W (17 dBW)
76000-77500	Secondary	Secondary	50W (17 dBW)
77500-78000	Primary	Primary	50W (17 dBW)
78000-79000	Secondary	Secondary	50W (17 dBW)
79000-81000	Secondary	Secondary	50W (17 dBW)
122250-123000	Secondary	Not allocated	50W (17 dBW)
134000-136000	Primary	Primary	50W (17 dBW)
136000-141000	Secondary	Secondary	50W (17 dBW)
241000-248000	Secondary	Secondary	50W (17 dBW)
248000-250000	Primary	Primary	50W (17 dBW)

Table C
Full Licence Parameters

Frequency Bands (in MHz)	Status of allocations in UK to the Amateur Service	Status of allocations in UK to the Amateur Satellite Service	Maximum Peak Envelope Power level in Watts (and dB relative to 1 Watt)
0.1357-0.1378	Secondary. Available on the basis of non-interference to other services inside or outside the UK.	Not allocated	1W (0 dBW) e.r.p.
1.810-1.830	Primary. Available on the basis of non-interference to other services outside the UK	Not allocated	400W (26 dBW)
1.830-1.850	Primary	Not allocated	400W (26 dBW)
1.850-2.000	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	32W (15 dBW)
3.500-3.800	Primary. Shared with other services	Not allocated	400W (26 dBW)
7.000-7.100	Primary	Primary	400W (26 dBW)
7.100-7.200	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	400W (26 dBW)
10.100-10.150	Secondary	Not allocated	400W (26 dBW)
14.000-14.250	Primary	Primary	400W (26 dBW)
14.250-14.350	Primary	Not allocated	400W (26 dBW)
18.068-18.168	Primary	Primary	400W (26 dBW)
21.000-21.450	Primary	Primary	400W (26 dBW)
24.890-24.990	Primary	Primary	400W (26 dBW)
28.000-29.700	Primary	Primary	400W (26 dBW)
50.00-51.00	Primary. Available on the basis of non-interference to other services outside the UK	Not allocated	400W (26 dBW)
51.00-52.00	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	100W (20 dBW)
70.00-70.50	Secondary. Available on the basis of non-interference to other services inside or outside the UK	Not allocated	160W (22 dBW)
144.0-146.0	Primary	Primary	400W (26 dBW)
430.0-431.0	Secondary	Not allocated	40W (16 dBW) e.r.p.
431.0-432.0	Secondary. Not available for use; within 100km radius of Charing Cross, London (51°30'30"N, 00°07'24"W)	Not allocated	40W (16 dBW) e.r.p.
432.0-435.0	Secondary	Not allocated	400W (26 dBW)
435.0-438.0	Secondary	Secondary	400W (26 dBW)
438.0-440.0	Secondary	Not allocated	400W (26 dBW)
1240-1260	Secondary	Not allocated	400W (26 dBW)
1260-1270	Secondary	Secondary. Earth to space only	400W (26 dBW)
1270-1325	Secondary	Not allocated	400W (26 dBW)

... continued

Full Licence Parameters (continued)

Frequency Bands (in MHz)	Status of allocations in UK to the Amateur Service	Status of allocations in UK to the Amateur Satellite Service	Maximum Peak Envelope Power level in Watts (and dB relative to 1 Watt)
2310-2400	Secondary	Not allocated	400W (26 dBW)
2400-2450	Secondary. Users must accept interference from ISM users.	Secondary. Users must accept interference from ISM users.	400W (26 dBW)
3400-3475	Secondary	Not allocated	400W (26 dBW)
5650-5670	Secondary	Secondary. Earth to space only	400W (26 dBW)
5670-5680	Secondary	Not allocated	400W (26 dBW)
5755-5765	Secondary. Users must accept interference from ISM users	Not allocated	400W (26 dBW)
5820-5830	Secondary. Users must accept interference from ISM users	Not allocated	400W (26 dBW)
5830-5850	Secondary. Users must accept interference from ISM users	Secondary. Users must accept interference from ISM users. Space to Earth only.	400W (26 dBW)
10000-10125	Secondary	Not allocated	400W (26 dBW)
10225-10450	Secondary	Not allocated	400W (26 dBW)
10450-10475	Secondary	Secondary	400W (26 dBW)
10475-10500	Not allocated	Secondary	400W (26 dBW)
24000-24050	Primary. Users must accept interference from ISM users	Primary. Users must accept interference from ISM users	400W (26 dBW)
24050-24150	Secondary. May only be used with the written consent of Ofcom. Users must accept interference from ISM users	Not allocated	400W (26 dBW)
24150-24250	Secondary	Not allocated	400W (26 dBW)
47000-47200	Primary	Primary	400W (26 dBW)
75500-75875	Secondary	Secondary	400W (26 dBW)
75875-76000	Primary	Primary	400W (26 dBW)
76000-77500	Secondary	Secondary	400W (26 dBW)
77500-78000	Primary	Primary	400W (26 dBW)
78000-79000	Secondary	Secondary	400W (26 dBW)
79000-81000	Secondary	Secondary	400W (26 dBW)
122250-123000	Secondary	Not allocated	400W (26 dBW)
134000-136000	Primary	Primary	400W (26 dBW)
136000-141000	Secondary	Secondary	400W (26 dBW)
241000-248000	Secondary	Secondary	400W (26 dBW)
248000-250000	Primary	Primary	400W (26 dBW)

Schedule 2

Additional restrictions which apply to the Unattended Operation of Beacons

Frequencies	Full Licence, Full (Reciprocal) Licence, Full (Temporary Reciprocal) Licence, Full (Club) Licence	Intermediate Licence	Foundation Licence
1.960 MHz	(1)	(1)	Not allocated
3.510 MHz -3.543 MHz	(1)	Not allocated	Not allocated
3.553 MHz - 3.600 MHz	(1)	Not allocated	Not allocated
28.000 MHz - 28.100 MHz	Not within 50 km of NGR SK 985640 (1)	Not allocated	Not allocated
28.100 MHz - 28.500 MHz	Not within 50 km of NGR SK 985640 (1)	Not within 50 km of NGR SK 985640 (1)	Not allocated
28.500 MHz – 29.700 MHz	Not within 50 km of NGR SK 985640 (1)	Not allocated	Not allocated
70.000 MHz - 70.500 MHz		Not allocated	Not allocated
144.000 MHz - 146.000 MHz	Not within 50 km of NGR TA 012869 (1) (2)	Not allocated	Not allocated
1298 – 1299 MHz	Not in N. Ireland and not within 50 km of NGR SS 206127 and NGR SE 202577	Not in N. Ireland and not within 50 km of NGR SS 206127 and NGR SE 202577	Not allocated
2310.0000 MHz - 2310.4125 MHz	Not within 50 km of NGR SS 206127 and NGR SE 202577	Not allocated	Not allocated
2310.4125 MHz - 2355.0000 MHz		Not allocated	Not allocated
2355 MHz - 2365 MHz	Not within 50 km of NGR SS 206127 and NGR SE 202577	Not allocated	Not allocated
2365 MHz - 2392 MHz		Not allocated	Not allocated
2392 MHz - 2450 MHz	Not within 50 km of NGR SS 206127 and NGR SE 202577	Not allocated	Not allocated
3400 MHz - 3420 MHz		Not allocated	Not allocated
3420 MHz - 3430 MHz	Not within 50 km of NGR SO 916223, NGR SS 206127 and NGR SE 202577	Not allocated	Not allocated
3430 MHz - 3450 MHz		Not allocated	Not allocated
3450 MHz - 3455 MHz	Not within 50 km of NGR SO 916223, NGR SS 206127 and NGR SE 202577	Not allocated	Not allocated
3455 MHz - 3475 MHz		Not allocated	Not allocated
5650 MHz - 5670 MHz		Not allocated	Not allocated
5670 MHz - 5680 MHz	Not within 50 km of NGR SS 206127 and NGR SE 202577	Not allocated	Not allocated
5755 MHz - 5765 MHz		Not allocated	Not allocated
5820 MHz - 5850 MHz		Not allocated	Not allocated
10000 MHz – 10125 MHz	Not within 50 km of NGR SO 916223, SS 206127, NGR SK 985640 and NGR SE 202577	Not within 50 km of NGR SS 206127, NGR SK 985640 or NGR SE 202577	Not allocated
10400 MHz – 10475 MHz			Not allocated
24000 MHz – 24050 MHz	Not within 50 km of NGR SK 985640 and NGR SE 202577	Not allocated	Not allocated
47000 MHz – 47200 MHz	Not within 50 km of NGR SK 985640 and NGR SE 202577	Not allocated	Not allocated

... continued

Notes to additional restrictions which apply to the unattended operation of beacons

(1) May only be used for the purpose of direction finding competitions. The Beacon must transmit the Callsign of the Licensee in accordance with Clause 13 of this Licence and it must be possible to switch the Beacon off within two hours of a demand to close down by a person authorised by Ofcom.

(2) It is permissible to transmit positional information using automatic position reporting software on a spot frequency of 144.800 MHz at any one temporary location not within 50 km of NGR TA 012869. The maximum permitted period of unattended operation is 30 minutes.

Notes to schedule 2

(a) The Unattended Operation of Beacons is only permitted within the frequency bands:

- I. Which are listed in the first column of Schedule 2; or
- II. which are above 75500 MHz and are listed in the first column of Schedule 1 providing that such operation is not within 50 km of NGR SK 985640 and NGR SE 202577.

(b) Beacons may operate with a maximum power level of 25 W e.r.p. pep.

Section 6

Annex B (Informative)

- 6.1 Stations capable of Remote Control Operation for general unsupervised use by other Radio Amateurs (e.g. repeater stations, certain beacon stations etc.) are subject to successful frequency co-ordination and are not covered by the licensing regime in this document.
- 6.2 It is recommended that operation is in accordance with the UK Amateur Radio Band Plans as published in the Radio Society of Great Britain Yearbook 2007 – see pages 180 – 185.

Section 7

Contact details

Ofcom, Riverside House, 2a Southwark Bridge Road, London, SE1 9HA

Technical enquiries to the Ofcom Licensing Centre:-

- Tel: 020 7981 3131

- Fax: 020 7981 3333

Email: licensingcentre@ofcom.org.uk

- Website: <http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/amateur/>

Section 8

Document history

Version	Date	Changes
1.0	Jan 2001	Initial Publication
1.1	2 Feb 2006	Published in Ofcom format.
1.2	24 Apr 2006	Editorial corrections and alignment with International tables of certain bands.
1.3	20 Sep 2006	Alignment of certain bands with international Tables and addition of unattended Beacons
1.4	Jan 2007	Frequency bands updated and editorial corrections