International Telecommunication Union

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Radiocommunication Sector of ITU

Recommendation ITU-R M.1732
(06/2005)

Characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies

M Series

Mobile, radiodetermination, amateur and related satellite services

International Telecommunication Union

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Note: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

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RECOMMENDATION ITU-R M.1732*

Characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies

(Question ITU-R 48-4/8)

(2005)

Scope

This Recommendation documents the technical and operational characteristics of systems used in the amateur service and amateur-satellite services for the purposes of carrying out sharing studies. The systems and their characteristics described in this Recommendation are considered representative of those operating in the frequency bands available to these services ranging from 135.7 kHz through 47.2 GHz.

The ITU Radiocommunication Assembly,

considering

a) that the Radio Regulations (RR) defines an amateur service and an amateur-satellite service and allocates frequencies to them on an exclusive or shared basis;

b) that systems in the amateur and amateur-satellite services operate over a wide range of frequencies;

c) that the technical characteristics of systems operating in the amateur and amateur-satellite services may vary within a band;

d) that some ITU-R technical groups are considering the potential for the introduction of new types of systems or services in bands used by systems operating in the amateur and amateur-satellite services;

e) that representative technical and operational characteristics of systems operating in the amateur and amateur-satellite services are required to determine the feasibility of introducing new types of systems into frequency bands in which the amateur and amateur-satellite services operate,

recommends

1 that the technical and operational characteristics of systems operating in the amateur and amateur-satellite services described in Annex 1 should be considered representative of those operating in the frequency bands allocated to the amateur and amateur-satellite services;

2 that Recommendation ITU-R M.1044 should be used as a guide in studies of the compatibility between systems operating in the amateur and amateur-satellite services and systems operating in other services.

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* This Recommendation should be brought to the attention of Radiocommunication Study Group 1.

Annex 1

Characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies

1 Introduction

A number of frequency bands are allocated to the amateur and amateur-satellite services throughout the spectrum. These bands have been selected to provide different propagation conditions.

Amateur and amateur-satellite stations perform a variety of functions, such as:

– training, intercommunication between amateur stations and technical investigations by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest (RR Nos. 1.56 and 1.57);

– disaster relief communications as elaborated in Recommendation ITU-R M.1042.

2 Operational characteristics

Amateur stations and amateur-satellite earth stations generally do not have assigned frequencies but dynamically select frequencies within an allocated band using listen-before-talk techniques. Terrestrial repeaters, digital relay stations and amateur satellites use frequencies selected on the basis of voluntary coordination within the amateur services. Some amateur frequency allocations are exclusive to the amateur and amateur-satellite services. Many of the allocations are shared with other radio services and amateur operators are aware of the sharing limitations.

Communications may be initiated on prearranged schedule or by one station initiating a general or specific call. One or more stations may respond. Formal and informal nets may be initiated as needed. Contacts may last from about 1 min to about 1 h, depending on traffic to be transmitted.

Operating protocols vary according to communication requirements and propagation. MF and HF bands are used for near-vertical-incidence-sky wave to global paths. VHF, UHF and SHF bands are used for short-range communications. Amateur satellites afford an opportunity to use frequencies above HF for long-distance communications.

3 Technical characteristics

Tables 1 to 6 contain technical characteristics of representative systems operating in the amateur and amateur-satellite services. This information is sufficient for general calculation to assess the compatibility between these systems and systems operating in other services. The upper frequency boundaries shown in Tables 1 to 6 represent the state of current amateur system deployment, which is expected to extend to higher frequencies over time.

TABLE 1

Characteristics of amateur systems for Morse on-off keying

Parameter	Value							
Mode of operation	Continuous wave (CW) Morse 10-50 Bd				Continuous wave (CW) Morse < 20 Bd (Earth-moon-Earth)			Slow Morse ≤ 1 Bd CW
Frequency band (MHz)[1]	1.8-7.3	10.1-29.7	50-450	902-47 200	144	432	1 296	0.136
Necessary bandwidth and class of emission (emission designator)	150HA1A 150HJ2A	150HA1A 150HJ2A	150HA1A 150HJ2A	150HA1A 150HJ2A	50H0A1A 50H0J2A	50H0A1A 50H0J2A	50H0A1A 50H0J2A	1H00A1B 1H00J2B
Transmitter power (dBW)[2]	3-31.7	3-31.7	3-31.7	3-31.7	3-31.7	3-31.7	17-31.7	23
Transmitter line loss (dB)	0.2	0.3-0.9	1-2	0-10	1-2	1-2	1-4	0.0
Transmitting antenna gain (dBi)	–20 to 15	–10 to 21	0-26	10-40	20-26	20-26	25-40	–22
Typical e.i.r.p. (dBW)	–17.2 to 46.5	–7.3 to 52.4	2-55	1-45	38-55	38-55	68	1
Antenna polarization	Horizontal, vertical	Horizontal, vertical	Horizontal	Horizontal, vertical	Horizontal	Horizontal, vertical, LHCP, RHCP	Horizontal, vertical, LHCP, RHCP	Vertical
Receiver IF bandwidth (kHz)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Receiver noise figure (dB)[3]	13	7-13	0.5-2	1-7	1	1	1	13

[1] With the exception of the band around 0.136 MHz, the amateur bands within the frequency ranges shown conform to RR Article 5.

[2] Maximum powers are determined by each administration.

[3] Receiver noise figures for bands above 50 MHz assume the use of low-noise preamplifiers.

LHCP: left-hand circular polarization

RHCP: right-hand circular polarization

TABLE 2

Characteristics of amateur systems for narrow-band direct printing telegraphy and data

Parameter	Value					
Mode of operation[1]	PSK31 31 Bd	NBDP 50 Bd	PACTOR 2	PACTOR 3	CLOVER 2000	MFSK16
Frequency band (MHz)[2]	1.8-29.7	1.8-29.7	1.8-29.7	1.8-29.7	1.8-29.7	1.8-29.7
Necessary bandwidth and class of emission (emission designator)	60H0J2B	250HF1B	375HJ2D	2K20J2D	2K00J2D 2K00J2B	316HJ2D 316HJ2B
Transmitter power (dBW)[3]	3-31.7	3-31.7	3-31.7	3-31.7	3-31.7	3-31.7
Feeder loss (dB)	0.2-0.9	0.2-0.9	0.2-0.9	0.2-0.9	0.2-0.9	0.2-0.9
Transmitting antenna gain (dBi)	–20 to 21	–20 to 21	–20 to 21	–20 to 21	–20 to 21	–20 to 21
Typical e.i.r.p. (dBW)	–17.2 to 52.5	–17.2 to 52.5	–17.2 to 52.5	–17.2 to 52.5	–17.2 to 52.5	–17.2 to 52.5
Antenna polarization	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical
Receiver IF bandwidth (kHz)	0.5	0.5	0.5	2.7	2.4	0.5
Receiver noise figure (dB)[4]	7-13	7-13	7-13	7-13	7-13	7-13

[1] PSK31 is a data system using phase shift keying (PSK) at 31.1 bauds. PACTOR 2 is a data system using differential PSK (DPSK) modulation with rates varying according to conditions. PACTOR 3 is a data system with a potential throughput of up to 5.2 kbit/s. CLOVER 200 is a digital data system capable of rates up to 5.2 kbit/s. MFSK16 is a data system using 16-tone frequency shift keying (FSK) and forward error correction (FEC).

Further information about these modes of operation can be obtained from the ARRL HF Digital Handbook, American Radio Relay League, ISBN: 0-87259-915-9, published 2003.

[2] Amateur bands within the frequency ranges shown conform to RR Article 5.

[3] Maximum powers are determined by each administration.

[4] Receiver noise figures for bands above 50 MHz assume the use of low-noise preamplifiers.

TABLE 3

Characteristics of amateur analogue voice systems

Parameter	Value					
Mode of operation	Single side-band (SSB) voice				FM voice	
Frequency band (MHz)[1]	1.8-7.3	10.1-29.7	50-450	902-47 200	50-450	902-47 200
Necessary bandwidth and class of emission (emission designator)	2K70J3E	2K70J3E	2K70J3E	2K70J3E	11K0F3E 16K0F3E 20K0F3E	11K0F3E 16K0F3E 20K0F3E
Transmitter power (dBW)[2]	3-31.7	3-31.7	3-31.7	3-31.7	3-31.7	3-31.7
Feeder loss (dB)	0.2	0.3-0.9	1-2	0-10	1-2	0-10
Transmitting antenna gain (dBi)	–20 to 15	–10 to 21	0-23	0-40	0-26	0-40
Typical e.i.r.p. (dBW)	–16.8 to 46.5	–7.3 to 52.4	2-53.7	1-45	2-55	1-45
Antenna polarization	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical
Receiver IF bandwidth (kHz)	2.7	2.7	2.7	2.7	9 15	9 15
Receiver noise figure (dB)[3]	13	7-13	0.5-2	1-7	0.5-2	1-7

[1] Amateur bands within the frequency ranges shown conform to RR Article 5.

[2] Maximum powers are determined by each administration.

[3] Receiver noise figures for bands above 50 MHz assume the use of low-noise preamplifiers.

TABLE 4

Characteristics of amateur digital voice and multimedia systems

Parameter	Value				
Mode of operation	Digital voice			Digital voice and multimedia	
Frequency band (MHz)[1]	1.8-7.3	10.1-29.7	50-450	1 240-1 300	5 650-10 500
Necessary bandwidth and class of emission (emission designator)	2K70J2E	2K70J2E	2K70J2E 5k76G1E 8K10F1E	2K70G1D 6K00F7D 16K0D1D 150KF1W	2K70G1D 6K00F7D 16K0D1D 150KF1W 10M5F7W
Transmitter power (dBW)[2]	3-31.7	3-31.7	3-31.7	1-10	3
Feeder loss (dB)	0.2	0.3-0.9	1-2	1-3	1-6
Transmitting antenna gain (dBi)	–20 to 15	–10 to 21	0-26	30	36
Typical e.i.r.p. (dBW)	–16.8 to 46.5	–7.3 to 52.4	2-55	39	38
Antenna polarization	Horizontal, vertical	Horizontal, vertical	Horizontal	Horizontal, vertical	Horizontal, vertical
Receiver IF bandwidth (kHz)	2.7	2.7	2.7 5.76 8.1	2.7, 6, 16, 130	2.7, 6, 16, 130, 10 500
Receiver noise figure (dB)[3]	13	7-13	1	2	2

[1] Amateur bands within the frequency ranges shown conform to RR Article 5.

[2] Maximum powers are determined by each administration.

[3] Receiver noise figures for bands above 50 MHz assume the use of low-noise preamplifiers.

TABLE 5

Characteristics of amateur-satellite systems in the Earth-to-space direction

Mode of operation	CW Morse, 10-50 Bd			SSB voice, digital voice, FM voice, data		
Frequency band (MHz)[1]	28	144-5 670	10 450-24 050	28	144-5 670	10 450-24 050
Necessary bandwidth and class of emission (emission designator)	150HA1A 150HJ2A	150HA1A 150HJ2A	150HA1A 150HJ2A	2K70J3E 2K70J2E 16K0F3E	2K70J3E 16K0F3E 44K2F1D 88K3F1D	2K70J3E 16K0F3E 44K2F1D 88K3F1D
Transmitter power (dBW)[2]	0-20	0-20	0-13	0-20	0-20	0-13
Feeder loss (dB)	0.2-1.5	0.2-3	0.2-3	0.2-1.5	0.2-3	0.2-3
Transmitting antenna gain (dBi)	–2 to 10	–2 to 27	–2 to 31	–2 to 10	–2 to 27	–2 to 31
Typical e.i.r.p. (dBW)	10-29	10-45	10-42	10-29	10-45	10-42
Antenna polarization	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP
Receiver IF bandwidth (kHz)	0.4	0.4	0.4	2.7 16	2.7, 16, 50, 100	2. 7, 16, 50, 100
Receiver noise figure (dB)[3]	3-10	1-3	1-7	3-10	1-3	1-7

[1] Amateur bands within the frequency ranges shown conform to RR Article 5.

[2] Maximum powers are determined by each administration.

[3] Receiver noise figures for bands above 50 MHz assume the use of low-noise preamplifiers.

TABLE 6

Characteristics of amateur-satellite systems in the space-to Earth direction

Mode of operation	CW Morse, 10-50 Bd			SSB voice, digital voice, FM voice, data		
Frequency band (MHz)[1]	28	144-5 850	10 450-24 050	28	144-5 850	10 450-24 050
Necessary bandwidth and class of emission (emission designator)	150HA1A 150HJ2A	150HA1A 150HJ2A	150HA1A 150HJ2A	2K70J3E 2K70J2E 16K0F3E	2K70J3E 16K0F3E 44K2F1D 88K3F1D	2K70J3E 16K0F3E 44K2F1D 88K3F1D
Transmitter power (dBW)[2]	10	10	10	10	10	0-10
Feeder loss (dB)	0.2-1	0.2-1	0.2-1	0.2-1	0.2-1	0.2-1
Transmitting antenna gain (dBi)	0	0-6	0-6	0	0	0-6
Typical e.i.r.p. (dBW)	9	9-15	9-15	9	9-15	9-15
Antenna polarization	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP	Horizontal, vertical, RHCP, LHCP
Receiver IF bandwidth (kHz)	0.4	0.4	0.4	2.7, 16	2.7, 16, 50, 100	2.7, 16, 50, 100
Receiver noise figure (dB)[3]	3-10	1-3	1-7	3-10	1-3	1-7

(1) Amateur bands within the frequency ranges shown conform to RR Article 5.

(2) While total transmitter power of 20 dB is assumed, 10 dBW is used as power is shared among signals in passband.

(3) Receiver noise figures for bands above 50 MHz assume the use of low-noise preamplifiers.