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**ITU-R**  
Radiocommunication Sector of ITU

**Report ITU-R M.2281-0**  
(12/2013)

**Characteristics of amateur radio stations  
in the range 5 250-5 450 kHz  
for sharing studies**

**M Series**  
**Mobile, radiodetermination, amateur  
and related satellite services**



International  
Telecommunication  
Union

## Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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<b>SM</b>	Spectrum management

*Note: This ITU-R Report was approved in English by the Study Group under the procedure detailed in Resolution ITU-R 1.*

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## REPORT ITU-R M.2281-0

**Characteristics of amateur radio stations in the  
range 5 250-5 450 kHz for sharing studies<sup>1</sup>**

(2013)

**Scope**

This Report describes the transmission characteristics of amateur radio systems most likely to be employed in amateur radio operations at frequencies in the range 5 250-5 450 kHz including an overview of antenna systems likely to be used in the amateur service at these frequencies.

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**1 Introduction**

Recommendation ITU-R M.1732 describes the characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies. This Report provides typical transmission modes and characteristics of stations in the amateur service that could be deployed in the range 5 250-5 450 kHz.

**2 Related ITU-R Recommendations**

- Recommendation ITU-R M.1677 – International Morse code
- Recommendation ITU-R M.1732 – Characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies
- Recommendation ITU-R M.1798 – Characteristics of HF radio equipment for the exchange of digital data and electronic mail in the maritime mobile service
- Recommendation ITU-R M.2034 – Telegraphic alphabet for data communication by phase shift keying at 31 baud in the amateur and amateur-satellite services

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<sup>1</sup> This Report has been prepared in support of World Radiocommunication Conference 2015 (WRC-15) agenda item 1.4. In the event that WRC-15 does not make an allocation to the amateur service in this band, the Report will be suppressed.

### 3 Abbreviations

ARQ	Automatic Repeat reQuest error-correction
BPSK	Binary phase shift keying
CW	Continuous wave (Morse code) signaling
FEC	Forward error correction
FSK	Frequency-shift keying
NBDP	Narrow-band direct printing
PACTOR	Packet teleprinting over radio
PSK31	Phase shift keying 31.25 Hz
QPSK31	Quadrature phase shift keying 31.25 Hz
TPO	Transmitter power output

### 4 General

Amateur stations generally do not have assigned frequencies but dynamically select frequencies within a band allocated to the amateur service using a listen-before-talk protocol. Many bands allocated to the amateur service are shared with other radio services and amateur operators are aware of the sharing conditions. Amateur stations in the frequency range 5 250-5 450 kHz could perform a variety of functions similar in nature to those performed in other bands allocated to the amateur service, such as training, communication between amateur stations, disaster relief communications and technical investigations in radio techniques for personal as opposed to pecuniary interest.

### 5 Characteristics of radiated signals

The characteristics of the radiated signals may be taken from Recommendation ITU-R M.1732 – Characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies. Although the scope of this Recommendation is limited to the frequency bands designated for the amateur service in Article 5 of the Radio Regulations, the columns encompassing 1.8-7.3 MHz fairly characterize stations most likely to be employed in the frequency range 5 250-5 450 kHz. The relevant characteristics from Recommendation ITU-R M.1732 are summarized in Table 1.

TABLE 1  
 Characteristics of transmissions in the range 5 250-5 450 kHz

Parameter	Value				
Mode of operation	Continuous wave (CW) Morse 10-50 Bd (See Rec. ITU-R M.1677)	PSK31 31 Bd NBDP 50 Bd MFSK 16 (See Rec. ITU-R M.2034)	PACTOR 3 (See Rec. ITU-R M.1798)	Single side-band (SSB) voice	Digital voice
Necessary bandwidth and class of emission (emission designator)	150HA1A 150HJ2A	60H0J2B 250HF1B 316HJ2D	2K20J2D	2K70J3E	2K70J2E
Transmitter power (dBW)	3-31.7	3-31.7	3-31.7	3-31.7	3-31.7
Transmitter line loss (dB)	0.2	0.2	0.2	0.2	0.2
Transmitting antenna gain (dBi)	-20 to 15	-20 to 15	-20 to 15	-20 to 15	-20 to 15
Typical e.i.r.p. (dBW)	-17.2 to 46.5	-17.2 to 52.5	-17.2 to 46.5	-16.8 to 46.5	-16.8 to 46.5
Antenna polarization	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical	Horizontal, vertical
Receiver IF bandwidth (kHz)	0.4	0.5	0.4	2.7	2.7
Receiver noise figure (dB)	13	13	13	13	13

Recommendation ITU-R M.1732 contemplates a broad range of transmitter power outputs, as maximum transmitter power varies among administrations in frequency bands allocated to the amateur service in the 1.8-7.3 MHz range. In the range 5 250-5 450 kHz, an e.i.r.p. limitation to protect incumbent services would be contemplated. One administration operates a system with an e.i.r.p. of 22.14 dBW in applying No. 4.4 of the Radio Regulations.

Amateur radio operators routinely use much lower power levels. Most commercial radio amateur equipment ranges from 100-150 Watts (TPO). The maximum TPO permitted to amateur radio operators is defined by the individual licensing administration.

## 6 Typical antenna systems

Antenna systems likely to be used by radio amateurs in the range 5 250-5 450 kHz would not differ significantly from antenna systems used in the amateur radio bands at 3.5 and 7.0 MHz. These antenna systems might include:

- Horizontal dipole antennas – typically one-half wavelength long;
- Vertical antennas, typically 1/4 or 5/8 wavelength with ground radials;

- Tuned “inverted L” antennas;
- Yagi or “beam” antennas – although size at 5 MHz would be a significant impediment.

## 7 Reference material

The following reference material lists a number of sources of further information on the history, use and technical characteristics of these modes.

- ARRL HF Digital Handbook, American Radio Relay League, ISBN: 0-87259-103-4, 4<sup>th</sup> Edition 2007.
  - ARRL Handbook for Radio Communications, American Radio Relay League, ISBN: 978-0-87259-667-1, 89<sup>th</sup> Edition 2012.
  - RSGB Radio Communications Handbook, Radio Society of Great Britain ISBN: 9781-9050-8674-0.
  - Digital modes (RAC) <http://www.rac.ca/opsinfo/infodig.htm>.
  - Ham radio operating modes <http://www.ac6v.com/opmodes.htm>.
  - PSK31 <http://mars.superlink.net/~driller/page2.htm#PSK31>.
  - Ham radio digimodes  
[http://www.electronics-radio.com/articles/ham\\_radio/digimodes/digital-modes-summary.php](http://www.electronics-radio.com/articles/ham_radio/digimodes/digital-modes-summary.php).
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