



Recommendation ITU-R M.1458
(05/2000)

**Use of the frequency bands between
2.8-22 MHz by the aeronautical mobile (R)
service for data transmission using class
of emission J2D**

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

Foreword

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Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

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.1458^{**} ****USE OF THE FREQUENCY BANDS BETWEEN 2.8-22 MHz BY
THE AERONAUTICAL MOBILE (R) SERVICE FOR DATA
TRANSMISSION USING CLASS OF EMISSION J2D**

(Question ITU-R 221/8)

(2000)

Scope

This Recommendation provides information on digital systems, including technical characteristics, for use in the frequency bands between 2.8-22 MHz that are allocated to the aeronautical mobile (R).

The ITU Radiocommunication Assembly,

considering

- a) that the use of the frequencies in the frequency bands allocated to the aeronautical mobile (R) service (AM(R)S) in the bands between 2.8-22 MHz is governed by the provisions of RR Appendix 27;
- b) the provisions of No. 27/15 of RR Appendix 27 on the use of frequencies with classes of emission other than J3E or H2B;
- c) the operational need for the introduction of data link services in the HF band (HF data link) for messages related to the safety and regularity of flight for use by international civil aviation;
- d) that ICAO has completed standards and recommended practices (SARPs) for HF data link; and operation in the frequency bands between 2.8-22 MHz, allocated to the AM(R)S;
- e) that the Radio Regulations Board (RRB) approved procedures concerning the use of the channels identified in RR Appendix 27 for various classes of emission other than J3E and H2B,

recommends

- 1 that coordination between administrations of frequency assignments to stations providing HF data link with class of emission J2D in the frequency bands between 2.8-22 MHz, allocated to the AM(R)S, be based on the technical characteristics contained in Annex 1;
- 2 that the technical and operational principles used for the establishment of the Plan of allotment of frequencies in the AM(R)S, as contained in RR Appendix 27, are also applicable for assignments with class of emission J2D that conform with the provisions of Annex 1.

ANNEX 1

1 Frequency bands

HF data link installations should be capable of operating at any single-sideband (SSB) carrier (reference) frequency available to the AM(R)S in the frequency bands between 2.8-22 MHz, and in compliance with the relevant provisions of the RR.

* This Recommendation should be brought to the attention of the International Civil Aviation Organization (ICAO).

** Radiocommunication Study Group 5 made editorial amendments to this Recommendation in 2008 in accordance with Resolution ITU-R 44.

2 Channels

Channel utilization should be in conformity with the table of carrier (reference) frequencies of No. 27/16 of RR Appendix 27.

3 Sideband

The sideband used for transmission should be on the higher side of its carrier (reference) frequency.

4 Modulation

HF data link should employ M -ary phase shift keying (M -PSK) to modulate the radio-frequency carrier at the assigned frequency.

M -PSK carrier

The M -PSK carrier expressed mathematically should be defined as:

$$s(t) = A \sum (p(t - kT) \cos [2\pi f_0 t + \varphi(k)]) \quad \text{for } k = 0, 1, \dots, N - 1$$

where:

- N : number of M -PSK symbols in transmitted physical layer protocol data unit
- $s(t)$: analogue waveform or signal at time t
- A : peak amplitude
- f_0 : SSB carrier (reference) + 1 440 Hz
- T : M -PSK symbol period (1/1 800 s)
- $\varphi(k)$: phase of k -th M -PSK symbol
- $p(t - kT)$: pulse shape of k -th M -PSK symbol at time t .

NOTE 1 – The number of M -PSK symbols sent, N , defines the length (duration = NT s) of the physical layer protocol data unit.

5 Pulse shape

The pulse shape, $p(t)$, should determine the spectral distribution of the transmitted signal. The Fourier transform of the pulse shape, $P(f)$, shall be defined by:

$$\begin{aligned} P(f) &= 1 && \text{if } 0 < |f - f_0| < (1 - b)/2T \\ P(f) &= \cos(\pi(2|f|T - 1 + b)/4b) && \text{if } (1 - b)/2T < |f - f_0| < (1 + b)/2T \\ P(f) &= 0 && \text{if } |f - f_0| > (1 + b)/2T \end{aligned}$$

where the spectral roll-off parameter, $b = 0.31$, has been chosen so that the -20 dB points of the signal are at SSB carrier (reference) + 290 Hz and SSB carrier (reference) + 2 590 Hz and the peak-to-average power ratio of the waveform is less than 5 dB.

6 Frequency tolerance for high frequency data links (HF DL)

The frequency tolerance should be as follows:

- 20 Hz for HF DL aircraft station subsystems, and
- 10 Hz for HF DL ground station subsystems.

7 Protection

A 15 dB desired to undesired signal ratio should apply for the protection of co-channel assignments for HF DL as follows:

- data versus data,
- data versus voice, and
- voice versus data.

NOTE 1 – See also Nos. 27/25 and 27/28 of RR Appendix 27.

8 Class of emission

The class of emission should be J2DEN.

9 Assigned frequency

The SSB assigned frequency should be 1 400 Hz higher than the SSB carrier (reference) frequency (see No. 27/75 of RR Appendix 27).

NOTE 1 – The HF DL assigned frequency is offset from the channel carrier frequency by 1 400 Hz. The digital modulation is fully contained within the same overall channel bandwidth as the voice signal and complies with the provisions of RR Appendix 27.

NOTE 2 – In accordance with RR No. 1.148 the assigned frequency is the centre of the frequency band assigned to a station. As the frequency band for HF DL is 2 800 Hz, relative to the carrier (reference) frequency the assigned frequency is 1 400 Hz higher than the carrier (reference) frequency.

10 Limits to the power level of recommended emissions

The tolerance for levels of emission outside the necessary bandwidth conform with Nos. 27/69 (suppressed carrier), 27/73 and 27/74 of RR Appendix 27.

11 Power

The transmission power limits are in conformance with Nos. 27/60 and 27/68 of RR Appendix 27.

12 Undesired signal rejection

For HF DL aircraft and ground station receivers, undesired input signals shall be attenuated in accordance with the following:

- on any frequency between f_c and $(f_c - 300 \text{ Hz})$, or between $(f_c + 2 900 \text{ Hz})$ and $(f_c + 3 300 \text{ Hz})$: at least 35 dB below the peak of the desired signal level; and
- on any frequency below $(f_c - 300 \text{ Hz})$, or above $(f_c + 3 300 \text{ Hz})$: at least 60 dB below the peak of the desired signal level,

where f_c is the carrier (reference) frequency.
