

RECOMMENDATION ITU-R M.478-5*

**TECHNICAL CHARACTERISTICS OF EQUIPMENT AND PRINCIPLES GOVERNING
THE ALLOCATION OF FREQUENCY CHANNELS BETWEEN 25 AND 3000 MHz
FOR THE FM LAND MOBILE SERVICE**

(Question ITU-R 7/8)

(1970-1974-1978-1982-1990-1995)

Summary

The rapid development of the different applications of land mobile services in the frequency bands between 25 and 3000 MHz requires the recommendation of technical characteristics of FM equipment and principles governing the allocation of frequency channels. The analogue and digitized voice transmissions may share the same frequency bands and channels with minimal interference between the systems. The Recommendation gives the preferred technical characteristics for VHF and UHF land mobile equipment using F3E class of emission, including the considerations of the necessary bandwidth, the transmitter, the receiver and the station characteristics.

The ITU Radiocommunication Assembly,

considering

- a) that certain technical characteristics of equipment and stations in the land mobile service are of importance in connection with radio interference between the stations of different countries;
- b) that agreement is desirable on certain technical characteristics of land mobile equipment, to minimize mutual interference and to facilitate the use of the same types of equipment in different countries in a geographical region;
- c) that agreement is desirable on the practices governing the choice of station antenna height and effective radiated power taking into account geographical features, required communications range and system parameters;
- d) that agreement is desirable on the practices governing the allocation of channels in the land mobile service, in order to minimize mutual interference and to obtain economy of use of the frequency spectrum;
- e) that in some areas, different values for the technical characteristics of equipment are required, in order to minimize mutual interference;
- f) that the values agreed upon should be based on circumstances that typify high-density radio usage areas and should be a compromise between optimum spectrum utilization and cost;
- g) that under some circumstances, e.g. where channel assignments and/or types of system operation permit, not all recommended technical characteristics are required to minimize mutual interference;
- h) that in the land mobile service, ultimate spectrum utilization is determined by assignment techniques, suppression and rejection of unwanted radiation, and other means additional to the actual characteristics of the equipment;
- j) that there is a rapid development in methods of digitized voice and data transmission using various coding techniques;
- k) that analogue and digitized voice transmissions may share the same frequency band and channels with minimal interference between these systems;

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

- l) that, in Opinion ITU-R 42, the International Electrotechnical Commission (IEC) has been invited to advise the ITU-R (former CCIR) of any methods of measurement applicable to radio equipment used in land mobile services;
- m) that Recommendation ITU-R SM.1045 provides advice on frequency stability requirements for future use,

recommends

- 1 that the preferred technical characteristics for VHF and UHF land mobile equipment using F3E class of emission should be indicated in Annex 1;
- 2 that Annex 2 should be taken into account, as appropriate, in the allocation of channels in the land mobile service between 25 and 1 000 MHz;
- 3 that reference should also be made to the IEC Publication 489 on methods of measurement (see Note 5 of § 3 of Annex 1);
- 4 that reference should be made to Annex 3 for information on some example values if the 1 500 MHz band is to be used.

ANNEX 1

**Preferred technical characteristics for VHF and UHF land mobile equipment
using F3E class of emission**

1 Necessary bandwidth

The transmitter characteristics specified in § 2 are based on the following assumption regarding the necessary bandwidth (see Note 4).

1.1 For class F3E

30 and 25 kHz channel separations: 16 kHz

20 kHz channel separation:

Maximum permissible frequency deviation (kHz)	Necessary bandwidth (kHz)
± 4	14
± 5	16

12.5 and 15 kHz channel separation: 8.5 kHz or 11 kHz (see Note 5).

- NOTE 1 – Subsequent Class A designations refer to alternative values and measurement methods which are specified in the United States of America telecommunications standard TIA/EIA-603.
- NOTE 2 – Subsequent Class E designations refer to alternative values and measurement methods which are specified in European telecommunications standard ETS 300 086.
- NOTE 3 – Where reference is not made to Classes A or E, the class(es) are in agreement with the preferred values.
- NOTE 4 – Necessary bandwidth: For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions (from the Radio Regulations (RR)).
- NOTE 5 – Another value may be used by some administrations. Class A specifies 11 kHz for 12.5 kHz.

2 Transmitter characteristics

2.1 Frequency tolerance

Within the temperature ranges specified by each administration according to the environment, and for specified ranges of primary supply voltages, the frequency error of any carrier emission should not exceed the values given in Tables 1 or 2 (Class E only).

Table 1 specifies the frequency tolerance in ppm.

TABLE 1
Preferred tolerances for each frequency band

Channel spacing (kHz)	35 MHz		80 MHz		160 MHz		300 MHz		450 MHz		800 MHz		900 MHz	
	kHz ⁽¹⁾	ppm	kHz ⁽¹⁾	ppm	kHz ⁽¹⁾	ppm	kHz ⁽¹⁾	ppm	kHz ⁽¹⁾	ppm	kHz ⁽¹⁾	ppm	kHz ⁽¹⁾	ppm
20, 25 and 30	0.43	12	0.96	12	0.8	5	1.5	5	2.25	5	–	2.5 (M)(B) 1.5 (B)	2.7	2.5
12.5	–	–	1.0	12	0.8	5	–	–	1.35	3	–	–	1.35	1.5 (M)(B) 0.1 (B)

(1) Approximate values.

B: base station.

M: mobile or handheld portable equipment.

ppm: parts per million (10^{-6}).

Table 2 applies to Class E equipment which specifies the frequency tolerance in units of kHz for the various frequency bands.

TABLE 2
Class E frequency tolerances

Channel separation (kHz)	Frequency error limit (kHz)				
	Below 47 MHz	47-137 MHz	Above 137 to 300 MHz	Above 300 to 500 MHz	Above 500 to 1 000 MHz
20 and 25	± 0.6	± 1.35	± 2.00	± 2.00	± 2.50 ⁽¹⁾
12.5	± 0.6	± 1.00	± 1.00 (B) ± 1.50 (M)	± 1.00 (B) ± 1.50 (M) ⁽¹⁾	No value specified

(1) For handheld portable equipment having integral power supplies, the frequency error given shall not exceed over a temperature range of 0° to +30 °C. Under extreme temperature conditions, the frequency error shall not exceed:

- ± 2,50 kHz for a channel separation of 12.5 kHz between 300 and 500 MHz;
- ± 3,00 kHz for a channel separation of 20 and 25 kHz between 500 and 1 000 MHz.