

RECOMMENDATION ITU-R SM.1045-1

FREQUENCY TOLERANCE OF TRANSMITTERS

(Question ITU-R 54/1)

(1994-1997)

The ITU Radiocommunication Assembly,

considering

- a) that Appendix 7 (S2) to the Radio Regulations (RR) specifies permissible frequency tolerances applicable to certain categories of stations in the frequency range from 9 kHz to 40 GHz;
- b) that in many cases tighter frequency tolerances may contribute to a better utilization of the radio-frequency spectrum;
- c) that due to technological progress, transmitters with more stringent frequency stability than required by RR Appendix 7 (S2), can be manufactured at reasonable costs;
- d) that it may be desirable to revise RR Appendix 7 (S2);
- e) that long-term design objectives for frequency tolerances of transmitters should be developed based on an improvement of radio-frequency spectrum utilization and the operational, technical and economical requirements of the various radio services,

recommends

- 1 that the frequency tolerances given in column 1 of Table 1 should be applied for the installation of new stations;
- 2 that more stringent values than those given in column 1 of Table 1 should be used when operational and technical reasons require;
- 3 that the values given in column 2 of Table 1 for some frequency bands and categories of stations should be taken into consideration as the long-term design objective of transmitters based on advances in technology;
- 4 that further studies should be carried out by Radiocommunication Study Groups and administrations to determine long-term objective values of frequency tolerance for frequency bands and categories of stations for which values cannot be set at present in column 2 of Table 1.

TABLE 1

1 Transmitter frequency tolerance is defined in RR Article 1 (S1) and is expressed in parts in 10^6 , unless otherwise indicated $\pm 10^{-6}$.

2 The power shown for the various categories of stations is the peak envelope power (pep) for single-sideband transmitters and the mean power for all other transmitters, unless otherwise indicated. The term "power of a radio transmitter" is defined in RR Article 1 (S1).

Frequency bands (lower limits exclusive, upper limits inclusive)	Categories of stations	Frequency tolerance	
		Achievable now (Column 1)	Long-term design objective (Column 2)
9-1 606.5 kHz	Fixed (9-50 kHz)	100	12 Hz
	Fixed (50-240 kHz)	50	
	Fixed (240-535 kHz)	50	
	Land/coast	100 ⁽¹⁾	

TABLE 1 (Continued)

Frequency bands (lower limits exclusive, upper limits inclusive)	Categories of stations	Frequency tolerance	
		Achievable now (Column 1)	Long-term design objective (Column 2)
9-1 606.5 kHz (Cont.)	Land/coast – digital selective calling (DSC) Land/aeronautical Mobile/ship, emergency, survival Mobile/ship – DSC Mobile/aircraft Land mobile Radiodetermination Broadcasting	10 Hz 100 20 Hz ⁽²⁾ 10 Hz 100 100 100 10 Hz	(> 200 W, 50) 20 Hz
1 606.5-4 000 kHz	Fixed Fixed – single sideband (SSB) radiotelephony Fixed – frequency shift keying (FSK) radiotelegraphy and data transmission Land/coast, aeronautical, base Land/coast, base – SSB radiotelephony Land/coast – DSC Land/aeronautical – SSB Mobile/ship Mobile/ship – DSC Mobile/survival Mobile/aircraft, emergency position-indicating radiobeacons (EPIRBs) Mobile/aircraft – SSB Mobile/land Mobile/land – SSB radiotelephony, FSK radiotelegraphy Radiodetermination Broadcasting	15 20 Hz 10 Hz 50 (≤ 200 W, 100) ⁽¹⁾ 20 Hz 10 Hz 10 Hz 20 Hz (A1A, 50) ⁽²⁾ 10 Hz 20 Hz 100 20 Hz 50 40 Hz 10 (≤ 200 W, 20) 10 Hz	50 50
4-29.7 MHz	Fixed Fixed – SSB radiotelephony Fixed – radio telegraphy and data transmission Land/coast Land/coast – A1A Land/coast – DSC Land/aeronautical Land/aeronautical – SSB Land/base Land/base – SSB radiotelephony Mobile/ship Mobile/ship – A1A Mobile/ship – DSC Mobile/survival Mobile/aircraft	10 20 Hz 10 Hz 20 Hz ⁽¹⁾ 10 10 Hz 50 (≤ 500 W, 100) 10 Hz 20 20 Hz (≤ 500 W, 50 Hz) 50 Hz ^{(2), (3)} 10 10 Hz 50 Hz 100	

TABLE 1 (Continued)

Frequency bands (lower limits exclusive, upper limits inclusive)	Categories of stations	Frequency tolerance	
		Achievable now (Column 1)	Long-term design objective (Column 2)
4-29.7 MHz (<i>Cont.</i>)	Mobile/aircraft – SSB Mobile/land mobile Broadcasting Earth Space	20 Hz 40 ⁽⁴⁾ 10 Hz ⁽⁵⁾ 20 20	
29.7-108 MHz	Fixed Land Mobile Radiodetermination Broadcasting – sound Broadcasting – TV (vision and sound) Earth Space	20 (≤ 50 W, 30) 20 20 (portables ≤ 5 W, 40) 50 2 kHz (≤ 50 W, 3 kHz) 1 kHz ⁽⁶⁾ 20 20	12
108-470 MHz	Fixed Fixed multi-hop radio-relay with direct frequency conversion Land/coast Land/aeronautical Land/base Mobile/ship Mobile/ship on-board outside 156-174 MHz Mobile/survival Mobile/aircraft Mobile/land mobile Radiodetermination Broadcasting – digital sound Broadcasting – TV (vision and sound) Earth Space	5 15 5 (≤ 3 W, 10) 20 5 10 5 50 (156-174 MHz, 10) 30 (channels, 50 kHz, 50) 5 (portables ≤ 5 W, 15) 50 (108-117,975 MHz, 20) ⁽⁸⁾ 1 1 kHz ⁽⁶⁾ 20 20	5 ⁽⁷⁾ 10 5 ⁽⁷⁾
470-960 MHz	Fixed Land Mobile Mobile/aircraft Radiodetermination Broadcasting – TV (vision and sound) Earth Space	15 5 5 (≤ 3 W, 15) 20 500 ⁽⁸⁾ 1 kHz ⁽⁶⁾ 20 20	5 2.5 ⁽⁷⁾ 2.5 ⁽⁷⁾ 10
960-1 215 MHz	Aeronautical radionavigation/land, ship Aeronautical radionavigation/aircraft	20 ⁽⁹⁾ 50 ⁽⁹⁾	

TABLE 1 (Continued)

Frequency bands (lower limits exclusive, upper limits inclusive)	Categories of stations	Frequency tolerance	
		Achievable now (Column 1)	Long-term design objective (Column 2)
1 215-2 450 MHz	Fixed	50	15 ⁽¹⁰⁾
	Land	20	
	Mobile	20	
	Radiodetermination	500 ⁽⁸⁾	
	Broadcasting – terrestrial digital sound	1	
	Earth	20	10
	Space	20	
2 450 MHz-10.5 GHz	Fixed	50	30
	Land	50	
	Mobile	50	
	Radiodetermination	1 250 ⁽⁸⁾	
	Earth	50	10
	Space	50	20
10.5-30 GHz	Fixed	100	30
	Land	100	
	Mobile	100	
	Radiodetermination	5 000 ⁽⁸⁾	
	Broadcasting	100	50
	Earth	100	50
	Space	100	50
30-275 GHz	Fixed	150	
	Land	150	
	Mobile	150	
	Radiodetermination	5 000 ⁽⁸⁾	
	Broadcasting	100	
	Earth	100	75
	Space	100	75

- 1) For coast station transmitters used for direct-printing telegraphy or for data transmission, the tolerance is:
 - 5 Hz for narrow-band phase-shift keying (PSK);
 - 10 Hz for frequency-shift keying (FSK).
- 2) For ship station transmitters used for direct-printing telegraphy or for data transmission, the tolerance is:
 - 5 Hz for narrow-band PSK
 - 10 Hz for FSK.
- 3) For ship station transmitters in the band 26 175-27 500 kHz, on board small craft, with a carrier power not exceeding 5 W in o near coastal waters and utilizing A3E or F3E and G3E emissions, the frequency tolerance is 40×10^{-6} .
- 4) The tolerance is 50 Hz for SSB radiotelephone transmitters, except for those transmitters operating in the band 26 175-27 50 kHz, and not exceeding a peak envelope power of 15 W, for which the basic tolerance of 40×10^{-6} applies.
- 5) For A3E emissions with carrier power of 10 kW or less the tolerance is 15×10^{-6} and 10×10^{-6} in the bands 4-5.90 MHz an 5.90-29.7 MHz respectively.

or the case when an offset is used, the frequency tolerance is 500 Hz. For the case when precision offset is used the frequency tolerance of the vision carrier is 1 Hz.

The long term design objective for channel spacing of 12.5 kHz and below is 3×10^{-6} in frequency bands between 400 and 470 MHz and 1.5×10^{-6} for frequency bands between 470 and 960 MHz.

Where specific frequencies are not assigned to radar stations, the bandwidth occupied by the emissions of such stations shall be maintained wholly within the band allocated to the service and the indicated tolerance does not apply.

The tolerance for selective identification features (SIF) of secondary surveillance radar (SSR) interrogators is 200 kHz, and for SIF SR transponders 3 MHz.

The long term design objective for digital radio-relay systems with a capacity higher than 10 Mbit/s is 30×10^{-6} .

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