

Federal Communications Commission

§ 87.137

Frequency band (lower limit exclusive, upper limit inclusive), and categories of stations	Tolerance ¹	Tolerance ²
1215–2450 MHz	500	500
(8) Band-2450 to 10500 MHz: Radionavigation stations	6, 9 1250	1250 ^{6, 9}
(9) Band-10.5 GHz to 40 GHz: Radionavigation stations	5000	5000

¹This tolerance is the maximum permitted until January 1, 1990, for transmitters installed before January 2, 1985, and used at the same installation. Tolerance is indicated in parts in 10⁶ unless shown as Hertz (Hz).

²This tolerance is the maximum permitted after January 1, 1985 for new and replacement transmitters and to all transmitters after January 1, 1990. Tolerance is indicated in parts in 10⁶ unless shown as Hertz (Hz).

³For transmitters first approved after November 30, 1977.

⁴The tolerance for transmitters approved between January 1, 1966, and January 1, 1974, is 30 parts in 10⁶. The tolerance for transmitters approved after January 1, 1974, and stations using offset carrier techniques is 20 parts in 10⁶.

⁵The tolerance for transmitters approved after January 1, 1974, is 30 parts in 10⁶.

⁶In the 5000 to 5250 MHz band, the FAA requires a tolerance of ±10 kHz for Microwave Landing System stations which are to be a part of the National Airspace System (FAR 171).

⁷For single-sideband transmitters operating in the frequency bands 1605–4000 kHz and 4–29.7 MHz which are allocated exclusively to the Aeronautical Mobile (R) Service, the tolerance is: Aeronautical stations, 10 Hz; aircraft stations, 20 Hz.

⁸For single-sideband radiotelephone transmitters the tolerance is: In the bands 1605–4000 kHz and 4–29.7 MHz for peak envelope powers of 200 W or less and 500 W or less, respectively, 50 Hz; in the bands 1605–4000 kHz and 4–29.7 MHz for peak envelope powers above 200 W and 500 W, respectively, 20 Hz.

⁹Where specific frequencies are not assigned to radar stations, the bandwidth occupied by the emissions of such stations must be maintained within the band allocated to the service and the indicated tolerance does not apply.

¹⁰Until January 1, 1997, the maximum frequency tolerance for transmitters with 50 kHz channel spacing installed before January 2, 1985, is 50 parts in 10⁶.

¹¹For purposes of certification, a tolerance of 160 Hz applies to the reference oscillator of the AES transmitter. This is a bench test.

(b) The power shown in paragraph (a) of this section is the peak envelope power for single-sideband transmitters and the mean power for all other transmitters.

(c) For single-sideband transmitters, the tolerance is:

- (1) All aeronautical stations on land other than Civil Air Patrol.....10 Hz
- (2) All aircraft stations other than Civil Air Patrol.....20 Hz
- (3) Civil Air Patrol Stations50 Hz

(d) For radar transmitters, except non-pulse signal radio altimeters, the frequency at which maximum emission

occurs must be within the authorized frequency band and must not be closer than 1.5/T MHz to the upper and lower limits of the authorized bandwidth, where T is the pulse duration in microseconds.

(e) The Commission may authorize tolerances other than those specified in this section upon a satisfactory showing of need.

(f) The carrier frequency tolerance of transmitters operating in the 1435–1535 MHz and 2310–2390 MHz bands manufactured before January 2, 1985, is 0.003 percent. The carrier frequency tolerance of transmitters operating in the 1435–1535 MHz and 2310–2390 MHz bands manufactured after January 1, 1985, is 0.002 percent. After January 1, 1990, the carrier frequency tolerance of all transmitters operating in the 1435–1535 MHz and 2310–2390 MHz bands is 0.002 percent.

[53 FR 28940, Aug. 1, 1988, as amended at 56 FR 38084, Aug. 12, 1991; 57 FR 45749, Oct. 5, 1992; 58 FR 31027, May 26, 1993; 63 FR 36607, July 7, 1998; 64 FR 27474, May 20, 1999]

§ 87.135 Bandwidth of emission.

(a) Occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5 percent of the total mean power of a given emission.

(b) The authorized bandwidth is the maximum occupied bandwidth authorized to be used by a station.

(c) The necessary bandwidth for a given class of emission is 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.

§ 87.137 Types of emission.

(a) The assignable emissions, corresponding emission designators and authorized bandwidths are as follows:

Class of emission	Emission designator	Authorized bandwidth (kilohertz)		
		Below 50 MHz	Above 50 MHz	Frequency deviation
A1A ¹	100HA1A	0.25		
A1N	300HA1N		0.75	
A2A	2K04A2A	2.74	50	

Class of emission	Emission designator	Authorized bandwidth (kilohertz)		
		Below 50 MHz	Above 50 MHz	Frequency deviation
A2D	6K0A2D		50	
A2D ⁵	13K0A2D		50	
A3E ²	6K00A3E		³ 50	
A3E	3K20A3E ¹⁵		¹⁵ 25	
A3X ⁴	3K20A3X		25	
A9W ⁵	13K0A9W		25	
F1B ¹	1K70F1B	1.7		
F1B ¹	2K40F1B	2.5		
F2D	5M0F2D		(⁹)	
F3E ⁶	16K0F3E		20	5
F3E ⁷	36K0F3E		40	15
F7D ⁸	5M0F7D		(⁹)	
F9D	5M0F9D		(⁹)	
G1D	16K0G1D		20kHz	
G1D ¹⁶	21K0G1D		25	
G1E ¹⁶	21K0G1E		25	
G1W ¹⁶	21K0G1W		25	
G3E ⁶	16K0G3E		20	5
G7D	14K0G7D		25	
H2B ^{10 11}	2K80H2B	3.0		
H3E ^{11 12}	2K80H3E	3.0		
J2A ¹	100HJ2A	0.25		
J2B ¹	1K70J2B	1.7		
	2K40J2B	2.5		
	2K80J3E	3.0		
	2K80J7B	3.0		
J3E ^{11 12}	5M0J7D		(⁹)	
J7B ¹¹	2K80J9W	3.0		
J7D	620HM1A			
J9W ¹¹	NON		None ¹⁵	
M1A	(⁹)		(⁹)	
NON	NON			
PON ¹³	(⁹)			
R3E ^{11 12}	2K80R3E	3.0		
XXA ¹⁴	1K12XXA	2.74		

NOTES:

- ¹ A1A, F1B, J2A and J2B are permitted provided they do not cause harmful interference to H2B, J3E, J7B and J9W.
- ² For use with an authorized bandwidth of 8.0 kilohertz at radiobeacon stations. A3E will not be authorized:
- (i) At existing radiobeacon stations that are not authorized to use A3 and at new radiobeacon stations unless specifically recommended by the FAA for safety purposes.
- (ii) At existing radiobeacon stations currently authorized to use A3, subsequent to January 1, 1990, unless specifically recommended by the FAA for safety purposes.
- ³ In the band 117.975–136 MHz, the authorized bandwidth is 25 kHz for transmitters approved after January 1, 1974.
- ⁴ Applicable only to Survival Craft Stations and to the emergency locator transmitters and emergency locator transmitter test stations employing modulation in accordance with that specified in § 87.141 of the Rules. The specified bandwidth and modulation requirements shall apply to emergency locator transmitters for which approval is granted after October 21, 1973.
- ⁵ This emission may be authorized for audio frequency shift keying and phase shift keying for digital data links on any frequency listed in § 87.263(a)(1), § 87.263(a)(3) or § 87.263(a)(5). 13K0A2D emission may be authorized on frequencies not used for voice communications. If the channel is used for voice communications, 13K0A9W emission may be authorized, provided the data is multiplexed on the voice carrier without derogating voice communications.
- ⁶ Applicable to operational fixed stations in the bands 72.0–73.0 MHz and 75.4–76.0 MHz and to CAP stations using F3 on 143.900 MHz and 148.150 MHz.
- ⁷ Applicable to operational fixed stations presently authorized in the band 73.0–74.6 MHz.
- ⁸ The authorized bandwidth is equal to the necessary bandwidth for frequency or digitally modulated transmitters used in aeronautical telemetering and associated aeronautical telemetry or telecommand stations operating in the 1435–1535 MHz and 2310–2390 MHz bands. The necessary bandwidth must be computed in accordance with part 2 of this chapter.
- ⁹ To be specified on license.
- ¹⁰ H2B must be used by stations employing digital selective calling.
- ¹¹ For A1A, F1B and single sideband emissions, except H2B, the assigned frequency must be 1400 Hz above the carrier frequency.
- ¹² R3E, H3E, and J3E will be authorized only below 25000 kHz. Only H2B, J3E, J7B, and J9W are authorized, except that A3E and H3E may be used only on 3023 kHz and 5680 kHz for search and rescue operations.
- ¹³ The letters "K, L, M, Q, V, W, and X" may also be used in place of the letter "P" for pulsed radars.
- ¹⁴ Authorized for use at radiobeacon stations.
- ¹⁵ Applicable only to transmitters of survival craft stations, emergency locator transmitter stations and emergency locator transmitter test stations approved after October 21, 1973.
- ¹⁶ Authorized for use by aircraft earth stations. Lower values of necessary and authorized bandwidth are permitted.

(b) For other emissions, an applicant must determine the emission designator by using part 2 of this chapter.

(c) A license to use radiotelephony includes the use of tone signals or signaling devices whose sole function is to

establish or maintain voice communications.

[53 FR 28940, Aug. 1, 1988, as amended at 55 FR 7333, Mar. 1, 1990; 55 FR 13535, Apr. 11, 1990; 55 FR 28627, July 12, 1990; 56 FR 11518, Mar. 19, 1991; 57 FR 45749, Oct. 5, 1992; 58 FR 30127, May 26, 1993; 63 FR 36607, July 7, 1998; 63 FR 68957, Dec. 14, 1998; 64 FR 27475, May 20, 1999]

§ 87.139 Emission limitations.

(a) Except for ELTs and when using single sideband (R3E, H3E, J3E), or frequency modulation (F9) or digital modulation (F9Y) for telemetry or telecommand in the frequency bands 1435–1535 MHz and 2310–2390 MHz or digital modulation (G7D) for differential GPS, the mean power of any emission must be attenuated below the mean power of the transmitter (pY) as follows:

(1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth the attenuation must be at least 25 dB;

(2) When the frequency is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth the attenuation must be at least 35 dB.

(3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aircraft station transmitters must be at least 40 dB; and the attenuation for aeronautical station transmitters must be at least $43 + 10 \log_{10} pY$ dB.

(b) For aircraft station transmitters and for aeronautical station transmitters first installed before February 1, 1983, and using H2B, H3E, J3E, J7B or J9W, the mean power of any emissions must be attenuated below the mean power of the transmitter (pY) as follows:

(1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 150 percent of the authorized bandwidth of 4.0 kHz, the attenuation must be at least 25 dB.

(2) When the frequency is removed from the assigned frequency by more than 150 percent up to and including 250 percent of the authorized bandwidth of 4.0 kHz, the attenuation must be at least 35 dB.

(3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth of 4.0 kHz for aircraft station transmitters the attenuation must be at least 40 dB; and for aeronautical station transmitters the attenuation must be at least $43 + 10 \log_{10} pY$ dB.

(c) For aircraft station transmitters first installed after February 1, 1983, and for aeronautical station transmitters in use after February 1, 1983, and using H2B, H3E, J3E, J7B or J9W, the peak envelope power of any emissions must be attenuated below the peak envelope power of the transmitter (pX) as follows:

(1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 150 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 30 dB.

(2) When the frequency is removed from the assigned frequency by more than 150 percent up to and including 250 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 38 dB.

(3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth of 3.0 kHz for aircraft transmitters the attenuation must be at least 43 dB. For aeronautical station transmitters with transmitter power up to and including 50 watts the attenuation must be at least $43 + 10 \log_{10} pX$ dB and with transmitter power more than 50 watts the attenuation must be at least 60 dB.

(d) Except for telemetry in the 1435–1535 MHz band, when the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth for aircraft stations above 30 MHz and all ground stations the attenuation must be at least $43 + 10 \log_{10} pY$ dB.

(e) When using frequency modulation or digital modulation for telemetry or telecommand in the 1435–1535 MHz and 2310–2390 MHz frequency bands with an authorized bandwidth equal to or less than 1 MHz the emissions must be attenuated as follows:

(1) On any frequency removed from the assigned frequency by more than