

| Class of station | Frequency band/ frequency | Authorized emission(s) ⁹ | Maximum power ¹ |
|---------------------------------|------------------------------|-------------------------------------|----------------------------|
| Marine Frequencies ⁵ | | | |
| | 156.300 MHz | G3E | 5 watts. |
| | 156.375 MHz | G3E | 5 watts. |
| | 156.400 MHz | G3E | 5 watts. |
| | 156.425 MHz | G3E | 5 watts. |
| | 156.450 MHz | G3E | 5 watts. |
| | 156.625 MHz | G3E | 5 watts. |
| | 156.800 MHz | G3E | 5 watts. |
| | 156.900 MHz | G3E | 5 watts. |
| | 157.425 MHz | G3E | 5 watts. |
| | HF ⁶ | R3E, H3E, J3E, J2B, F1B, A3E | 1000 watts. |
| | MF ⁶ | R3E, H3E, J3E, J2B, F1B | 250 watts. |
| | HF ⁶ | A3E | 1000 watts. |
| | Various ⁷ | Various ⁷ | 250 watts. |
| (Radionavigation) | Various ⁷ | Various ⁷ | Various. ⁷ |
| Aircraft earth | UHF | G1D, G1E, G1W | 60 watts. ⁸ |
| Differential GPS | VHF | G7D | Various. ² |

¹ The power is measured at the transmitter output terminals and the type of power is determined according to the emission designator as follows:
 (i) Mean power (pY) for amplitude modulated emissions and transmitting both sidebands using unmodulated full carrier.
 (ii) Peak envelope power (pX) for all emission designators other than those referred to in paragraph (i) of this note.
² Power and antenna height are restricted to the minimum necessary to achieve the required service.
³ Transmitter power may be increased to overcome line and duplexer losses but must not exceed 25 watts delivered to the antenna.
⁴ Frequency, emission, and maximum power will be determined after coordination with appropriate Government agencies.
⁵ To be used with airborne marine equipment certificated for part 80 (ship) and used in accordance with part 87.
⁶ Applicable only to marine frequencies used for public correspondence.
⁷ Frequency, emission, and maximum power will be determined by appropriate standards during the certification process.
⁸ Power may not exceed 60 watts per carrier, as measured at the input of the antenna subsystem, including any installed diplexer. The maximum EIRP may not exceed 2000 watts per carrier.
⁹ Excludes automatic link establishment.
¹⁰ Power is limited to 0.5 watt, but may not exceed 2 watts when station is used in an automatic unattended mode.

[54 FR 11720, Mar. 22, 1989, as amended at 57 FR 45749, Oct. 5, 1992; 62 FR 40308, July 28, 1997; 63 FR 36607, July 7, 1998; 64 FR 27474, May 20, 1999; 66 FR 26798, May 15, 2001; 69 FR 32880, June 14, 2004; 78 FR 61205, Oct. 3, 2013]

§ 87.133 Frequency stability.

(a) Except as provided in paragraphs (c), (d), (f), and (g) of this section, the carrier frequency of each station must be maintained within these tolerances:

| Frequency band (lower limit exclusive, upper limit inclusive), and categories of stations | Tolerance ¹ | Tolerance ² |
|---|------------------------|------------------------|
| (1) Band-9 to 535 kHz: Aeronautical stations | 100 | 100 |
| Aircraft stations | 200 | 100 |
| Survival craft stations on 500 kHz. | 5,000 | 20 Hz ³ |
| Radionavigation stations | 100 | 100 |
| (2) Band-1605 to 4000 kHz: Aeronautical fixed stations: Power 200 W or less | 100 | 100 ⁸ |
| Power above 200 W | 50 | 50 ⁸ |
| Aeronautical stations: Power 200 W or less | 100 ⁷ | 100 ^{7 8} |
| Power above 200 W | 50 ⁷ | 50 ^{7 8} |
| Aircraft stations | 100 ⁷ | 100 ⁷ |
| Survival craft stations on 2182 kHz. | 200 | 20 Hz ³ |
| (3) Band-4 to 29.7 MHz: Aeronautical fixed stations: Power 500 W or less | 50 | |
| Power above 500 W | 15 | |
| Single-sideband and Independent-sideband emission: Power 500 W or less | | 50 Hz |

| Frequency band (lower limit exclusive, upper limit inclusive), and categories of stations | Tolerance ¹ | Tolerance ² |
|---|------------------------|------------------------|
| Power above 500 W | | 20 Hz |
| Class F1B emissions | | 10 Hz |
| Other classes of emission: Power 500 W or less | | 20 |
| Power above 500 W | | 10 |
| Aeronautical stations: Power 500 W or less | ⁷ 100 | 100 ⁷ |
| Power above 500 W | ⁷ 50 | 50 ⁷ |
| Aircraft stations | ⁷ 100 | 100 ⁷ |
| Survival craft stations on 8364 kHz. | 200 | 50 Hz ³ |
| (4) Band-29.7 to 100 MHz: Aeronautical fixed stations: Power 200 W or less | 50 | |
| Power above 200 W | 30 | |
| Power 50 W or less | | 30 |
| Power above 50 W | | 20 |
| Operational fixed stations: 73–74.6 MHz (Power 50 W or less). | 50 | 30 |
| 73–74.6 MHz (Power above 50 W). | 20 | 20 |
| 72–73.0 MHz and 75.4–76.0 MHz. | 5 | 5 |
| Radionavigation stations | 100 | 50 |
| (5) Band-108 to 137 MHz: Aeronautical stations | ⁴ 50 | ¹² 20 |
| Emergency locator transmitter test stations. | 50 | 50 |

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| Frequency band (lower limit exclusive, upper limit inclusive), and categories of stations | Tolerance ¹ | Tolerance ² |
|---|------------------------|------------------------|
| Survival craft stations on 121.5 MHz. | 50 | 50 |
| Emergency locator stations | 50 | 50 |
| Aircraft and other mobile stations in the Aviation Services. | ⁵ 50 | ¹³ 30 |
| Radionavigation stations | 20 | 20 |
| Differential GPS | | 2 |
| (6) Band-137 to 470MHz: | | |
| Aeronautical stations | 50 | 20 |
| Survival craft stations on 243 MHz. | 50 | 50 |
| Aircraft stations | ⁵ 50 | ³⁰ 10 |
| Radionavigation stations | 50 | 50 |
| Emergency locator transmitters on 406 MHz. | N/A | 5 |
| (7) Band-470 to 2450 MHz: | | |
| Aeronautical stations | 100 | 20 |
| Aircraft stations | 100 | 20 |
| Aircraft earth station | | 320 Hz ¹¹ |
| Aeronautical utility mobile stations on 1090 MHz. | 1000 | 1000 |
| Radionavigation stations: | | |
| 470–960 MHz | 500 | 500 |
| 960–1215 MHz | 20 | 20 |
| 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.

¹²For emissions G1D and G7D, the tolerance is 2 parts per 10⁶.

¹³For emissions G1D and G7D, the tolerance is 5 parts per 10⁶.

(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—10 Hz.

(2) All aircraft stations—20 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.

(g) Any aeronautical enroute service transmitter operating in U.S. controlled airspace with 8.33 kHz channel spacing (except equipment being tested by avionics equipment manufacturers and flight test stations prior to delivery to their customers for use outside U.S. controlled airspace) must achieve 0.0005% frequency stability when operating in that mode.

[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; 66 FR 26799, May 15, 2001; 69 FR 32880, June 14, 2004; 76 FR 17350, Mar. 29, 2011; 78 FR 61205, Oct. 3, 2013]

§ 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.