

§ 87.141

⁴The upper limit for the excess power for any narrow-band spurious emission (excluding intermodulation products within a 30 kHz measurement bandwidth) shall be 10 dB above the power limit in this table.

(2) The transmitter emission limit is a function of the modulation type and symbol rate (SR). Symbol Rate is expressed in symbols per second.

(3) While transmitting a single modulated signal at the rated output power of the transmitter, the emissions must be attenuated below the maximum emission level by at least:

Frequency Offset (normalized to SR)	Attenuation (dB)
$\pm 0.75 \times SR$	0
$\pm 1.40 \times SR$	20
$\pm 2.95 \times SR$	40

Where:

SR = Symbol Rate,
 SR = $1 \times$ channel rate for BPSK,
 SR = $0.5 \times$ channel rate for QPSK.

The mask shall be defined by drawing straight lines through the above points.

(j) When using G7D for differential GPS in the 112–118 MHz band, the amount of power during transmission under all operating conditions when measured over a 25 kHz bandwidth centered on either of the second adjacent channels shall not exceed –25 dBm and shall decrease 5 dB per octave until –52 dBm.

(k) For VHF aeronautical stations and aircraft stations operating with G1D or G7D emissions:

(1) The amount of power measured across either first adjacent 25 kHz channel shall not exceed 2 dBm.

(2) For stations first installed before January 1, 2002, the amount of power measured across either second adjacent channel shall be less than –25 dBm and the power measured in any other adjacent 25 kHz channels shall monotonically decrease at a rate of at least 5 dB per octave to a maximum value of –52 dBm. For stations first installed on or after January 1, 2002,

(i) The amount of power measured across either second adjacent 25 kHz channel shall be less than –28 dBm;

(ii) The amount of power measured across either fourth adjacent 25 kHz channel shall be less than –38 dBm; and

(iii) From thereon the power measured in any other adjacent 25 kHz

channel shall monotonically decrease at a rate of at least 5 dB per octave to a maximum value of –53 dBm.

(3) The amount of power measured over a 16 kHz channel bandwidth centered on the first adjacent 25 kHz channel shall not exceed –18 dBm.

(1)(1) For Universal Access Transceiver transmitters, the average emissions measured in a 100 kHz bandwidth must be attenuated below the maximum emission level contained within the authorized bandwidth by at least:

Frequency (MHz)	Attenuation (dB)
± 0.5	0
± 1.0	18
± 2.25	50
± 3.25	60

(2) Universal Access Transceiver transmitters with an output power of 5 Watts or more must limit their emissions by at least $43 + 10 \log(P)$ dB on any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth. Those emissions shall be measured with a bandwidth of 100 kHz. P in the above equation is the average transmitter power measured within the occupied bandwidth in Watts.

(3) Universal Access Transceiver transmitters with less than 5 Watts of output power must limit their emissions by at least 40 dB relative to the carrier peak on any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth. Those emissions shall be measured with a bandwidth of 100 kHz.

[53 FR 28940, Aug. 1, 1988, as amended at 56 FR 11518, Mar. 19, 1991; 57 FR 45749, Oct. 5, 1992; 58 FR 30127, May 26, 1993; 58 FR 67695, Dec. 22, 1993; 59 FR 35269, July 11, 1994; 63 FR 36607, July 7, 1998; 64 FR 27475, May 20, 1999; 66 FR 26799, May 15, 2001; 67 FR 4676, Jan. 31, 2002; 69 FR 32881, June 14, 2004; 71 FR 70676, Dec. 6, 2006]

§ 87.141 Modulation requirements.

(a) When A3E emission is used, the modulation percentage must not exceed 100 percent. This requirement does not apply to emergency locator transmitters or survival craft transmitters.

(b) A double sideband full carrier amplitude modulated radiotelephone transmitter with rated carrier power

output exceeding 10 watts must be capable of automatically preventing modulation in excess of 100 percent.

(c) If any licensed radiotelephone transmitter causes harmful interference to any authorized radio service because of excessive modulation, the Commission will require the use of the transmitter to be discontinued until it is rendered capable of automatically preventing modulation in excess of 100 percent.

(d) Single sideband transmitters must be able to operate in the following modes:

Carrier mode	Level N(dB) of the carrier with respect to peak envelope power
Full carrier (H3E)	O>N> -6.
Suppressed carrier (J3E)	Aircraft stations N< -26; Aeronautical stations N< -40.

(e) Each frequency modulated transmitter operating in the band 72.0-76.0 MHz must have a modulation limiter.

(f) Each frequency modulated transmitter equipped with a modulation limiter must have a low pass filter between the modulation limiter and the modulated stage. At audio frequencies between 3 kHz and 15 kHz, the filter must have an attenuation greater than the attenuation at 1 kHz by at least 40 log₁₀ (f/3) db where "f" is the frequency in kilohertz. Above 15 kHz, the attenuation must be at least 28 db greater than the attenuation at 1 kHz.

(g) Except that symmetric side bands are not required, the modulation characteristics for ELTs must be in accordance with specifications contained in the Federal Aviation Administration (FAA) Technical Standard Order (TSO) Document TSO-C91a titled "Emergency Locator Transmitter (ELT) Equipment" dated April 29, 1985. TSO-C91a is incorporated by reference in accordance with 5 U.S.C. 552(a). TSO-C91a may be obtained from the Department of Transportation, Federal Aviation Administration, Office of Airworthiness, 800 Independence Avenue SW., Washington DC 20591.

(h) ELTs must use A3X emission and may use A3E or NON emissions on an optional basis while transmitting. Each transmission of a synthesized or recorded voice message from an ELT must be preceded by the words "this is

a recording"; transmission of A3E or NON emission must not exceed 90 seconds; and any transmission of A3E or NON emissions must be followed by at least three minutes of A3X emission.

(i) ELTs manufactured on or after October 1, 1988, must have a clearly defined carrier frequency distinct from the modulation sidebands for the mandatory emission, A3X, and, if used, the A3E or NON emissions. On 121.500 MHz at least thirty per cent of the total power emitted during any transmission cycle with or without modulation must be contained within plus or minus 30 Hz of the carrier frequency. On 243.000 MHz at least thirty percent of the total power emitted during any transmission cycle with or without modulation must be contained within plus or minus 60 Hz of the carrier frequency. Additionally, if the type of emission is changed during transmission, the carrier frequency must not shift more than plus or minus 30 Hz on 121.500 MHz and not more than plus or minus 60Hz on 243.000 MHz. The long term stability of the carrier frequency must comply with the requirements in §87.133 of this part.

(j) Transmitters used at Aircraft earth stations must employ BPSK for transmission rates up to and including 2400 bits per second, and QPSK for higher rates.

(k) Universal Access Transceiver transmitters must use F1D modulation without phase discontinuities.

[53 FR 28940, Aug. 1, 1988, as amended at 54 FR 11721, Mar. 22, 1989; 56 FR 11518, Mar. 19, 1991; 57 FR 45749, Oct. 5, 1992; 71 FR 70676, Dec. 6, 2006]

§87.143 Transmitter control requirements.

(a) Each transmitter must be installed so that it is not accessible to, or capable of being operated by persons other than those authorized by the licensee.

(b) Each station must be provided with a control point at the location of the transmitting equipment, unless otherwise specifically authorized. Except for aeronautical enroute stations governed by paragraph (e) of this section, a control point is the location at which the radio operator is stationed.