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level greater than that specified in §101.111.

[61 FR 26677, May 28, 1996, as amended at 62 FR 23167, Apr. 29, 1997; 63 FR 6105, Feb. 6, 1998; 63 FR 9448, Feb. 25, 1998; 63 FR 14039, Mar. 24, 1998; 63 FR 36611, July 7, 1998; 66 FR 35110, July 3, 2001; 67 FR 43038, June 26, 2002; 68 FR 4956, Jan. 31, 2003; 69 FR 3266, Jan. 23, 2004; 69 FR 16832, Mar. 31, 2004; 70 FR 4787, Jan. 31, 2005]

§ 101.109 Bandwidth.

(a) Each authorization issued pursuant to these rules will show, as the emission designator, a symbol representing the class of emission which must be prefixed by a number specifying the necessary bandwidth. This figure does not necessarily indicate the bandwidth actually occupied by the emission at any instant. In those cases where part 2 of this chapter does not provide a formula for the computation of the necessary bandwidth, the occupied bandwidth may be used in the emission designator.

(b) Stations in this service will be authorized any type of emission, method of modulation, and transmission characteristic, consistent with efficient use of the spectrum and good engineering practice, except that Type B, damped-wave emission will not be authorized.

(c) The maximum bandwidth which will be authorized per frequency assigned is set out in the table that follows. Regardless of the maximum authorized bandwidth specified for each frequency band, the Commission reserves the right to issue a license for less than the maximum bandwidth if it appears that a lesser bandwidth would be sufficient to support an applicant's intended communications.

Frequency band (MHz)	Maximum authorized bandwidth
928 to 929	25 kHz ^{1,5,6}
932 to 932.5, 941 to 941.5	12.5 kHz ^{1,5,6}
932.5 to 935, 941.5 to 944	200 kHz ¹
952 to 960	200 KHz ^{1,5,6}
1,850 to 1,990	10 MHz ¹
2,110 to 2,130	3.5 MHz
2,130 to 2,150	800 or 1600 KHz ¹
2,150 to 2,160	10 MHz
2,160 to 2,180	3.5 MHz
2,180 to 2,200	800 or 1600 KHz ¹
2,450 to 2,483.5	625 KHz ²
2,483.5 to 2,500	800 KHz
3,700 to 4,200	20 MHz
5,925 to 6,425	30 MHz ¹
6,425 to 6,525	25 MHz
6,525 to 6,875	10 MHz ¹

Frequency band (MHz)	Maximum authorized bandwidth
10,550 to 10,680	5 MHz ¹
10,700 to 11,700	40 MHz ¹
12,200 to 12,700 ^a	500 megahertz
13,200 to 13,250	25 MHz
17,700 to 18,140	220 MHz ¹
18,140 to 18,142	2 MHz
18,142 to 18,580	6 MHz
18,580 to 18,820	20 MHz ¹
18,820 to 18,920	10 MHz
18,920 to 19,160	20 MHz ¹
19,160 to 19,260	10 MHz
19,260 to 19,700	220 MHz ¹
21,200 to 23,600	50 MHz ^{1,4}
24,250 to 25,250	40 MHz ⁷
27,500 to 28,350	850 MHz
29,100 to 29,250	150 MHz
31,000 to 31,075	75 MHz
31,075 to 31,225	150 MHz
31,225 to 31,300	75 MHz
38,600 to 40,000	50 MHz ⁷
71,000 to 76,000	5000 MHz
81,000 to 86,000	5000 MHz
92,000 to 95,000	(³)

¹The maximum bandwidth that will be authorized for each particular frequency in this band is detailed in the appropriate frequency table in §101.147. If contiguous channels are aggregated in the 928–928.85/952–952.85/956.25–956.45 MHz, the 928.85–929/959.85–960 MHz, or the 932–932.5/941–941.5 MHz bands, then the bandwidth may exceed that which is listed in the table.

²1250 KHz, 1875 KHz, or 2500 KHz on a case-by-case basis.

³To be specified in authorization. For the band 92 to 95 GHz, maximum bandwidth is licensed in one segment of 2 GHz from 92–94 GHz and one 0.9 GHz segment from 94.1 to 95 GHz, or the total of the loaded band if smaller than the assigned bandwidth.

⁴For exceptions, see § 101.147(s).

⁵A 12.5 kHz bandwidth applies only to frequencies listed in § 101.147(b)(1) through (4).

⁶For frequencies listed in § 101.147(b)(1) through (4), consideration will be given on a case-by-case basis to authorizing bandwidths up to 50 kHz.

⁷For channel block assignments in the 24,250–25,250 MHz and 38,600–40,000 MHz bands, the authorized bandwidth is equivalent to an unpaired channel block assignment or to either half of a symmetrical paired channel block assignment. When adjacent channels are aggregated, equipment is permitted to operate over the full channel block aggregation without restriction.

NOTE TO FOOTNOTE 7: Unwanted emissions shall be suppressed at the aggregate channel block edges based on the same roll-off rate as is specified for a single channel block in § 101.111(a)(1) or in § 101.111(a)(2)(ii) and (iii) as appropriate.

⁸For incumbent private operational fixed point-to-point stations in this band (those not licensed as MVDSS), the maximum bandwidth shall be 20 MHz.

[61 FR 26677, May 28, 1996, as amended at 61 FR 44181, Aug. 28, 1996; 62 FR 23167, Apr. 29, 1997; 62 FR 24582, May 6, 1997; 63 FR 6105, Feb. 6, 1998; 65 FR 17449, Apr. 3, 2000; 65 FR 38329, June 20, 2000; 65 FR 59358, Oct. 5, 2000; 67 FR 43038, June 26, 2002; 68 FR 4956, Jan. 31, 2003; 69 FR 3266, Jan. 23, 2004; 70 FR 29997, May 25, 2005]

§ 101.111 Emission limitations.

(a) The mean power of emissions must be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(1) When using transmissions other than those employing digital modulation techniques:

(i) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 decibels;

(ii) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 decibels;

(iii) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \text{ Log}_{10}$ (mean output power in watts) decibels, or 80 decibels, whichever is the lesser attenuation.

(2) When using transmissions employing digital modulation techniques (see § 101.141(b)) in situations not covered in this section:

(i) For operating frequencies below 15 GHz, in any 4 KHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 50 decibels:

$A = 35 + 0.8(P - 50) + 10 \text{ Log}_{10} B$. (Attenuation greater than 80 decibels or to an absolute power of less than -13 dBm/1MHz is not required.) where:

A = Attenuation (in decibels) below the mean output power level.

P = Percent removed from the center frequency of the transmitter bandwidth.

B = Authorized bandwidth in MHz.

NOTE: MVDDS operations in the 12.2–12.7 GHz band shall use 24 megahertz for the value of B in the emission mask equation set forth in this section. The emission mask limitation shall only apply at the 12.2–12.7 GHz band edges and does not restrict MVDDS channelization bandwidth within the band.

(ii) For operating frequencies above 15 GHz, in any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 11 decibels:

$A = 11 + 0.4(P - 50) + 10 \text{ Log}_{10} B$. (Attenuation greater than 56 decibels or

to an absolute power of less than -13 dBm/1MHz is not required.)

(iii) In any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \text{ Log}_{10}$ (the mean output power in watts) decibels, or 80 decibels, whichever is the lesser attenuation. The authorized bandwidth includes the nominal radio frequency bandwidth of an individual transmitter/modulator in block-assigned bands. Equipment licensed prior to April 1, 2005 shall only be required to meet this standard in any 4 kHz band.

(iv) The emission mask for LMDS and the 24 GHz Service shall use the equation in paragraph (a)(2)(ii) of this section and apply it only to the band edge of each block of spectrum, but not to subchannels established by licensees. The value of P in the equation is the percentage removed from the carrier frequency and assumes that the carrier frequency is the center of the actual bandwidth used. The emission mask can be satisfied by locating a carrier of the subchannel sufficiently far from the channel edges so that the emission levels of the mask are satisfied. The LMDS or 24 GHz emission mask shall use a value B (bandwidth) of 40 MHz, for all cases even in the case where a narrower subchannel is used (for instance the actual bandwidth is 10 MHz) and the mean output power used in the calculation is the sum of the output power of a fully populated channel. For block assigned channels, the out-of-band emission limits apply only outside the assigned band of operation and not within the band.

(v) The emission mask for the 71–76 GHz, 81–86 GHz, 92–94 GHz, and 94.1–95 GHz bands used in the equation in paragraph (a)(2)(ii) of this section applies only to the edge of each channel, but not to sub-channels established by licensees. The value of P in the equation is for the percentage removed from the carrier frequency and assumes that the carrier frequency is the center of the actual bandwidth used. The value of B will always be 500 MHz. In the case where a narrower sub-channel is used within the assigned bandwidth, such sub-carrier will be located sufficiently far from the channel edges to

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satisfy the emission levels of the mask. The mean output power used in the calculation is the sum of the output power of a fully populated channel.

(3) For Digital Termination System channels used in the Digital Electronic Message Service (DEMS) operating in the 10,550-10,680 MHz band:

(i) In any 4 KHz band, the center frequency of which is removed from the edge of the DEMS channel by up to and including 1.125 times the DEMS subchannel bandwidth: As specified by the following equation may in no event be less than $50+10 \log_{10} N$ decibels:

$$A = 50 + 0.0333(F - 0.5B) + 10 \log_{10} N \text{ decibels}$$

Where:

A = Attenuation (in decibels) below means output power level contained within the DEMS channel for a given polarization.

B = Bandwidth of DEMS channel (in KHz).

F = Absolute value of the difference between the center frequency of the 4 KHz band measured and the center frequency of the DEMS channel (in KHz).

N = Number of active subchannels of the given polarization within the DEMS channel.

(ii) In any 4 KHz band within the authorized DEMS band the center frequency of which is removed from the center frequency of the DEMS channel by more than the sum of 50% of the DEMS channel bandwidth plus 1.125 times the subchannel bandwidth: As specified by the following equation but in no event less than 80 decibels:

$$A = 80 + 10 \log_{10} N \text{ decibels}$$

(iii) In any 4 KHz band the center frequency of which is outside the authorized DEMS band: At least $43+10 \log_{10}$ (mean output power in watts) decibels.

(4) For DEMS channels in the 17,700-19,700 MHz band:

(i) In any 4 KHz band, the center frequency of which is removed from the frequency of the center of the DEMS channel by more than 50 percent of the DEMS channel bandwidth up to and including 50 percent plus 500 KHz: As specified by the following equation but in no event be less than $50+10 \log_{10} N$ decibels:

$$A = 50 + 0.06(F - 0.5B) + 10 \log_{10} N \text{ decibels}$$

Where:

A = Attenuation (in decibels) below means output power level contained within the DEMS channel for a given polarization.

B = Bandwidth of DEMS channel (in KHz).

F = Absolute value of the difference between the center frequency of the 4 KHz band measured and the center frequency of the DEMS channel (in KHz).

N = Number of active subchannels of the given polarization within the DEMS channel.

(ii) In any 4 KHz band within the authorized DEMS band, the center frequency of which is removed from the center frequency of the DEMS channel by more than the sum of 50 percent of the channel bandwidth plus 500 KHz: As specified by the following equation but in no event less than 80 decibels:

$$A=80+10 \log_{10} N \text{ decibels}$$

(iii) In any 4 KHz band the center frequency of which is outside the authorized Digital Message Service band: At least $43+10 \log_{10}$ (mean output power in watts) decibels.

(5) When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a 12.5 KHz bandwidth, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 2.5 KHz up to and including 6.25 KHz: At least $53 \log_{10} (fd/2.5)$ decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 6.25 KHz up to and including 9.5 KHz: At least $103 \log_{10} (fd/3.9)$ decibels;

(iii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 9.5 KHz up to and including 15 KHz: At least $157 \log_{10} (fd/5.3)$ decibels; and

(iv) On any frequency removed from the center of the authorized bandwidth by a displacement frequency greater than 15 KHz: At least 50 plus $10 \log_{10}(P)$ or 70 decibels, whichever is the lesser attenuation.

(6) When using transmissions employing digital modulation techniques on

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the 900 MHz multiple address frequencies with a bandwidth greater than 12.5 KHz, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 5 KHz up to and including 10 KHz: At least $83 \log_{10} (fd/5)$ decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 10 KHz up to and including 250 percent of the authorized bandwidth: At least $116 \log_{10} (fd/6.1)$ decibels or 50 plus $10 \log_{10} (P)$ or 70 decibels, whichever is the lesser attenuation; and

(iii) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 plus $10 \log_{10}$ (output power in watts) decibels or 80 decibels, whichever is the lesser attenuation.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraph (a) of this section.

(c) The emission of an unmodulated carrier is prohibited except for test purposes as required for proper station and system maintenance.

[61 FR 26677, May 28, 1996, as amended at 62 FR 24582, May 6, 1997; 65 FR 59358, Oct. 5, 2000; 67 FR 43038, June 26, 2002; 68 FR 4957, Jan. 31, 2003; 69 FR 3266, Jan. 23, 2004; 69 FR 31746, June 7, 2004]

§ 101.113 Transmitter power limitations.

(a) On any authorized frequency, the average power delivered to an antenna in this service must be the minimum amount of power necessary to carry out the communications desired. Application of this principle includes, but is not to be limited to, requiring a licensee who replaces one or more of its antennas with larger antennas to reduce its antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the

replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the values specified below. In cases of harmful interference, the Commission may, after notice and opportunity for hearing, order a change in the effective radiated power of this station. Further, the output power of a transmitter on any authorized frequency in this service may not exceed the following:

Frequency band (MHz)	Maximum allowable EIRP ^{1,2}	
	Fixed ^{1,2} (dBW)	Mobile (dBW)
928.0-929.0(2)	+17	
932.0-932.5(2)	+17	
932.5-935.0	+40	
941.0-941.5(2)	+30	+14
941.5-944.0	+40	
952.0-960.0(2)	+40	+14
1,850-1,990	+45	
2,110-2,150	+45	
2,150-2,180 ³	+45	
2,180-2,200	+45	
2,450-2,500	+45	
2,500-2,686		
2,686-2,690	+45	
3,700-4,200	+55	
5,925-6,425	+55	
6,425-6,525		+35
6,525-6,875	+55	
10,550 to 10,600 ⁵	+55	
10,600 to 10,680 ⁵	+40	
10,700-11,700	+55	
12,200-12,700 ¹¹	+50	
12,700-13,200 ⁴	+50	
13,200-13,250 ⁴	+55	
14,200-14,400 ¹²	+45	
17,700-18,600	+55	
18,600-18,800 ⁶	+35	
18,800-19,700	⁵ +55	
21,200-23,600 ¹⁰	+55	
24,250-25,250	⁵ +55	
27,500-28,350 ⁹	+55	
29,100-29,250	(7)	
31,000 to 31,075 ^{8,9}	30 dBW/MHz	30 dBW/MHz
31,075 to 31,225 ^{8,9}	30 dBW/MHz	30 dBW/MHz
31,225 to 31,300 ^{8,9}	30 dBW/MHz	30 dBW/MHz
38,600-40,000	+55	
92,000-95,000	+55	+55

¹ Per polarization.
² For multiple address operations, see § 101.147. Remote alarm units that are part of a multiple address central station projection system are authorized a maximum of 2 watts.
³ When an omnidirectional antenna is authorized in the 2150-2160 MHz band, the maximum power shall be 60 dBm.
⁴ Also see § 101.145.
⁵ The output power of a DEMS System nodal transmitter shall not exceed 0.5 watt per 250 kHz. The output power of a DEMS System user transmitter shall not exceed 0.04 watt per 250 kHz. The transmitter power in terms of the watts specified is the peak envelope power of the emission measured at the associated antenna input port. The operating power shall not exceed the authorized power by more than 10 percent of the authorized power in watts at any time. Frequencies from 10,600-10,680 MHz are subject to footnote US265 in the Table of Frequency Allocations in § 2.106 of the Commission's Rules. Stations authorized prior to April 1, 2003 to exceed the 40 dBW limit may continue to operate at their authorized output power level indefinitely, provided that neither end point of the relevant link is relocated.