

must be Honolulu, Hawaii (for a complex at Waimea); and the three (3) remaining complexes must be located at least 75 nautical miles from the borders of the 100 largest MSAs or in any MSA not included in the 100 largest MSAs. Any location allotted for one range of MSAs may be taken from an MSA below that range.

(3)(i) Any non-GSO MSS licensee may at any time specify sets of geographic coordinates for feeder link earth station complexes with each earth station contained therein to be located at least 75 nautical miles from the border of the 100 largest MSAs.

(ii) For purposes of paragraph (h)(3)(i) of this section, non-GSO MSS feeder link earth station complexes shall be entitled to accommodation only if the affected non-GSO MSS licensee preapplies to the Commission for a feeder link earth station complex or certifies to the Commission within sixty days of receiving a copy of an LMDS application that it intends to file an application for a feeder link earth station complex within six months of the date of receipt of the LMDS application.

(iii) If said non-GSO MSS licensee application is filed later than six months after certification of the Commission, the LMDS and non-GSO MSS entities shall still cooperate fully and make reasonable efforts to resolve technical problems, but the LMDS licensee shall not be obligated to re-engineer its proposal or make changes to its system.

(4) LMDS licensees or applicants proposing to operate hub stations on frequencies in the 29,100–29,250 MHz band at locations outside of the 100 largest MSAs or within a distance of 150 nautical miles from a set of geographic coordinates specified under paragraphs (h)(2) or (h)(3)(i) of this section shall serve copies of their applications on all non-GSO MSS applicants, permittees or licensees meeting the criteria specified in §25.257(a). Non-GSO MSS licensees or applicants shall serve copies of their feeder link earth station applications, after the LMDS auction, on any LMDS applicant or licensee within a distance of 150 nautical miles from the geographic coordinates that it specified under §101.113(c)(2) or (c)(3)(i). Any necessary coordination shall com-

mence upon notification by the party receiving an application to the party who filed the application. The results of any such coordination shall be reported to the Commission within sixty days. The non-GSO MSS earth station licensee shall also provide all such LMDS licensees with a copy of its channel plan.

(i)(1) When the licensed facilities are to be operated in the band 38,600 MHz to 40,000 MHz and the facilities are located within 16 kilometers of the boundaries of an Economic Area, each licensee must complete the frequency coordination process of subsection 101.103(d) with respect to neighboring EA licensees and existing licensees within its EA service area that may be affected by its operation prior to initiating service. In addition to the technical parameters listed in subsection 101.103(d), the coordinating licensee must also provide potentially affected parties technical information related to its subchannelization plan and system geometry.

(2) Response to notification should be made as quickly as possible, even if no technical problems are anticipated. Any response to notification indicating potential interference must specify the technical details and must be provided to the licensee, either electronically or in writing, within 10 days of notification. Every reasonable effort should be made by all licensees to eliminate all problems and conflicts. If no response to notification is received within 10 days, the licensee will be deemed to have made reasonable efforts to coordinate and may commence operation without a response. The beginning of the 10-day period is determined pursuant to §101.103(d)(v).

[61 FR 26677, May 28, 1996, as amended at 62 FR 23165, Apr. 29, 1997; 63 FR 6105, Feb. 6, 1998; 63 FR 9448, Feb. 25, 1998; 63 FR 14039, Mar. 24, 1998; 63 FR 68983, Dec. 14, 1998; 64 FR 45893, Aug. 23, 1999; 65 FR 38328, June 20, 2000; 67 FR 43037, June 26, 2002]

**§ 101.105 Interference protection criteria.**

(a) The interference protection criteria for fixed stations subject to this part are as follows:

(1) To long-haul analog systems, employing frequency modulated radio and

frequency division multiplexing to provide multiple voice channels, the allowable interference level per exposure:

(i) Due to co-channel sideband-to-sideband interference must not exceed 5 pwpO (Picowatts of absolute noise power psophometrically weighted (pwpO), appearing in an equivalent voice band channel of 300-3400 Hz); or

(ii) Due to co-channel carrier-beat interference must not exceed 50 pwpO.

(2) To short-haul analog systems employing frequency modulated radio and frequency division multiplexing to provide multiple voice channels, the allowable interference level per exposure:

(i) Due to co-channel sideband-to-sideband interference must not exceed 25 pwpO except in the 952-960 MHz band interference into single link fixed relay and control stations must not exceed 250 pwpO per exposure; or

(ii) Due to co-channel carrier-beat interference must not exceed 50 pwpO except in the 952-960 MHz band interference into single link fixed relay and control stations must not exceed 1000 pwpO per exposure.

(3) FM-TV. In analog systems employing frequency modulated radio that is modulated by a standard, television (visual) signal, the allowable interference level per exposure may not exceed the levels which would apply to long-haul or short-haul FM-FDM sys-

tems, as outlined in paragraphs (b) (1) and (2) of this section, having a 600-1200 voice channel capacity.

(4) 12.2-12.7 GHz band. (i) To accommodate co-primary NGSO FSS earth stations in the 12.2-12.7 GHz band, the PFD of an MVDDS transmitting system must not exceed -135 dBW/m<sup>2</sup> in any 4 kHz band at a reference point at the surface of the earth at a distance greater than 3 kilometers from the MVDDS transmitting antenna.

(ii) To accommodate co-primary Direct Broadcast Satellite Service earth stations, an MVDDS transmitting system must not exceed the EPFD levels specified in paragraph (a)(4)(ii)(B) of this section at any DBS subscriber location in accordance with the procedures listed in §101.1440 of this part.

(A) Definition of equivalent power flux density: The equivalent power flux density (EPFD) is the power flux density produced at a direct broadcast service (DBS) receive earth station, taking into account shielding effects and the off-axis discrimination of the receiving antenna assumed to be pointing at the appropriate DBS satellite(s) from the transmitting antenna of a multichannel video distribution and data service (MVDDS) transmit station. The EPFD in dBW/m<sup>2</sup> in the reference bandwidth is calculated using the following formula:

$$EPFD = 10 * \log_{10} \left[ \frac{P_{out} * G_m(\theta_m, \phi_m) * G_e(\theta_e, \phi_e) * I}{G_{e,max} * 4 * \pi * d^2} \right]$$

Where:

P<sub>out</sub> = Total output power of the MVDDS transmitter (watts) into antenna

G<sub>m</sub> (θ<sub>m</sub>, φ<sub>m</sub>) = Gain of the MVDDS antenna in the direction of the DBS earth station

G<sub>e</sub> (θ<sub>e</sub>, φ<sub>e</sub>) = Gain of the earth station in the direction of the MVDDS antenna

I = Interference scaling factor for the earth station (1 dB for MVDDS transmitters employing the modulation discussed in Section 3.1.5 of the MITRE Report (i.e., a QPSK modulated signal passed through a square-root raised cosine filter). For other modulation and filtering schemes, the interference scaling factor can be measured using the procedures described in Appendix A of the MITRE Report available at [http://](http://www.fcc.gov/oet/info/mitrereport/mitrereport_4_01.pdf)

[www.fcc.gov/oet/info/mitrereport/mitrereport\\_4\\_01.pdf](http://www.fcc.gov/oet/info/mitrereport/mitrereport_4_01.pdf).

G<sub>e,max</sub> = Maximum gain of the DBS earth station

d = the distance between the MVDDS transmitting antenna and the DBS earth station (meters)

(B) Regional equivalent power flux density levels:

(1) -168.4 dBW/m<sup>2</sup>/4kHz in the Eastern region consisting of the District of Columbia and the following states: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West

Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana, and Florida;

(2)  $-169.8$  dBW/m<sup>2</sup>/4kHz in the Midwestern region consisting of the following states: Ohio, Michigan, Indiana, Wisconsin, Illinois, Minnesota, Iowa, Missouri, Arkansas, South Dakota, Nebraska, Kansas, Oklahoma, and Texas;

(3)  $-171.0$  dBW/m<sup>2</sup>/4kHz in the Southwestern region consisting of the following states: Wyoming, Colorado, New Mexico, Utah, Arizona, Nevada, and California (south of 37° North Latitude);

(4)  $-172.1$  dBW/m<sup>2</sup>/4kHz in the Northwestern region consisting of the following states: Washington, Oregon, California (north of 37° North Latitude), Idaho, Montana, North Dakota, Alaska, and Hawaii.

(iii) Except for public safety entities, harmful interference protection from MVDDS stations to incumbent point-to-point 12 GHz fixed stations is not required. Incumbent point-to-point private operational fixed 12 GHz stations, except for public safety entities, are required to protect MVDDS stations under the process described in § 101.103(d) of this part.

(5) *71,000–76,000 MHz; 81,000–86,000 MHz.* In these bands the following interference criteria shall apply:

(i) For receivers employing digital modulation: based upon manufacturer data and following TSB 10-F or other generally acceptable good engineering practice, for each potential case of interference a threshold-to-interference ratio (T/I) shall be determined that would cause 1.0 dB of degradation to the static threshold of the protected receiver. For the range of carrier power levels (C) between the clear-air (unfaded) value and the fully-faded static threshold value, in no case shall interference cause C/I to be less than the T/I so determined unless it can be shown that the availability of the affected receiver would still be acceptable despite the interference.

(ii) For receivers employing analog modulation: manufacturer data or industry criteria will specify a baseband signal-to-noise requirement (S/N) of the receiver that will result in acceptable signal quality for continuous oper-

ation. Following TSB 10-F or other generally acceptable good engineering practice, for each potential case of interference a C/I objective shall be calculated to ensure that this S/N will not be degraded by more than 1.0 dB. For the range of carrier power levels (C) between the clear-air (unfaded) value and the fully-faded threshold value, in no case shall interference cause the C/I to be less than the objective so determined unless it can be shown that the signal quality and availability of the affected receiver would still be acceptable despite the interference.

(6) *92,000–94,000 MHz; 94,100–95,000 MHz.* In these bands prior links shall be protected to a threshold-to-interference ratio (T/I) level of 1.0 dB of degradation to the static threshold of the protected receiver. Any new link shall not decrease a previous link's desired-to-undesired (D/U) signal ratio below a minimum of 36 dB, unless the earlier link's licensee agrees to accept a lower D/U.

(7) All stations operating under this part must protect the radio quiet zones as required by § 1.924 of this chapter. Stations authorized by competitive bidding are cautioned that they must receive the appropriate approvals directly from the relevant quiet zone entity prior to operating.

(b) In addition to the requirements of paragraph (a) of this section the adjacent channel interference protection criteria to be afforded, regardless of system length, or type of modulation, multiplexing, or frequency band, must be such that the interfering signal does not produce more than 1.0 dB degradation of the practical threshold of the protected receiver. The "practical threshold" of the protected receiver can be based upon the definition in TSB 10, referenced in paragraph (c) of this section, or upon alternative generally acceptable good engineering standards.

(c) *Applying the criteria.* (1) Guidelines for applying the interference protection criteria for fixed stations subject to this part are specified in the Telecommunications Industry Association's Telecommunications Systems Bulletin TSB 10, "Interference Criteria for Microwave Systems" (TSB 10). Other procedures that follow generally

acceptable good engineering practices are also acceptable to the Commission.

(2) If TSB 10 guidelines cannot be used, the following interference protection criteria may be used by calculating the ratio in dB between the desired (carrier signal) and the undesired (interfering) signal (C/I ratio) appearing at the input to the receiver under investigation (victim receiver). Except as provided in §101.147 where the applicant's proposed facilities are of a type not included in paragraphs (a) and (b) of this section or where the development of the carrier-to-interference (C/I) ratio is not covered by generally acceptable procedures, or where the applicant does not wish to develop the carrier-to-interference ratio, the applicant must, in the absence of criteria or a developed C/I ratio, employ the following C/I protection ratios:

(i) *Co-Channel Interference.* Both side band and carrier-beat, applicable to all bands; the existing or previously authorized system must be afforded a carrier to interfering signal protection ratio of at least 90 dB, except in the 952-960 MHz band where it must be 75dB, and in the 71,000-76,000 MHz and 81,000-86,000 MHz bands where the criteria in paragraph (a)(5) of this section applies, and in the 92,000-94,000 MHz and 94,100-95,000 MHz bands, where the criteria in paragraph (a)(6) of this section applies; or

(ii) *Adjacent Channel Interference.* Applicable to all bands; the existing or previously authorized system must be afforded a carrier to interfering signal protection ratio of at least 56 dB, except in the 71,000-76,000 MHz and 81,000-86,000 MHz bands where the criteria in paragraph (a)(5) of this section applies, and in the 92,000-94,000 MHz and 94,100-95,000 MHz bands, where the criteria in paragraph (a)(6) of this section applies.

(3) Applicants for frequencies listed in §101.147(b)(1) through (4) must make the following showings that protection criteria have been met over the entire service area of existing systems. Such showings may be made by the applicant or may be satisfied by a statement from a frequency coordinator.

(i) For site-based multiple address stations in the 928-929/952-960 MHz and the 932-932.5/941-941.5 MHz bands, a statement that the proposed system

complies with the following co-channel separations from all existing stations and pending applications:

Fixed-to-fixed—145 km;  
Fixed-to-mobile—113 km;  
Mobile-to-mobile—81 km

NOTE TO PARAGRAPH (c)(3)(i): Multiple address systems employing only remote stations will be treated as mobile for the purposes of determining the appropriate separation. For mobile operation, the mileage is measured from the reference point specified on the license application. For fixed operation on subfrequencies in accordance with §101.147 the mileage also is measured from the reference point specified on the license application.

(ii) In cases where the geographic separation standard in paragraph (c)(3)(i) of this section is not followed, an engineering analysis must be submitted to show the coordination of the proposed assignment with existing systems located closer than those standards. The engineering analyses will include:

(A) Specification of the interference criteria and system parameters used in the interference study;

(B) Nominal service areas of each system included in the interference analysis;

(C) Modified service areas resulting from the proposed system. The propagation models used to establish the service boundary limits must be specified and any special terrain features considered in computing the interference impact should be described; and

(D) A statement that all parties affected have agreed to the engineering analysis and will accept the calculated levels of interference.

(iii) MAS EA licensees shall provide protection in accordance with §101.1333.

(4) Multiple address systems operating on subfrequencies in accordance with §101.147 that propose to operate master stations at unspecified locations must define the operating area by a radius about a geographical coordinate and describe how interference to co-channel users will be controlled.

(5) Multiple address frequencies in the 956.25-956.45 MHz bands may be assigned for use by mobile master stations on a primary basis. Multiple address frequencies in the 941.0-941.5 MHz bands that are licensed on a site-by-site basis and the 952 MHz bands may

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be assigned for use by primary mobile master stations on a case-by-case basis if the 956.25-956.45 MHz frequencies are unavailable. Multiple address mobile (master and remote) operation is permitted on frequencies licensed by geographic area subject to the interference protection criteria set forth in §101.1333, *i.e.*, adjacent channel site-based licensees and co-channel operations in adjacent EAs. Mobile operation in the 959.85-960 MHz band is not permitted.

(6) Each application for new or modified nodal station on channels numbered 4A, 4B, 7, 9, and 19/20 in the 10.6 GHz band must demonstrate that all existing co-channel stations are at least 56 kilometers from the proposed nodal station site. Applicants for these channels must certify that all licensees and applicants for stations on the adjacent channels within 56 kilometers of the proposed nodal station have been notified of the proposed station and do not object. Alternatively, or if one of the affected adjacent channel interests does object, the applicant may show that all affected adjacent channel parties are provided a C/I protection ratio of 0 dB. An applicant proposing to operate at an AAT greater than 91 meters must reduce its EIRP in accordance with the following table; however, in no case may EIRP exceed 70 dBm on the 10.6 GHz channels:

AAT (meters)	EIRP dBm
Above 300 .....	+38
251 to 300 .....	41
201 to 250 .....	43
151 to 200 .....	49
101 to 150 .....	55
100 and below .....	85

(7) Each application for new or modified nodal station on channels numbered 21, 22, 23, and 24 in the 10.6 GHz band must include an analysis of the potential for harmful interference to all other licensed and previously applied for co-channel and adjacent channel stations located within 80 kilometers of the location of the proposed station. The criteria contained in §101.103(d)(2) must be used in this analysis. Applicants must certify that copies of this analysis have been served on all parties which might reasonably be expected to receive interference above

the levels set out in §101.103(d)(2) within 5 days of the date the subject application is filed with the Commission.

(8) If the potential interference will exceed the prescribed limits, a statement shall be submitted with the application for new or modified stations to the effect that all parties have agreed to accept the higher level of interference.

(d) Effective August 1, 1985, when a fixed station that conforms to the technical standards of this subpart (or, in the case of the 12,200-12,700 MHz band, for an incumbent non-MVDDS station or a direct broadcast satellite station) receives or will receive interference in excess of the levels specified in this section as a result of an existing licensee's use of non-conforming equipment authorized between July 20, 1961 and July 1, 1976, and the interference would not result if the interfering station's equipment complied with the current technical standards, the licensee of the non-conforming station must take whatever steps are necessary to correct the situation up to the point of installing equipment which fully conforms to the technical standards of this subpart. In such cases, if the engineering analysis demonstrates that:

(1) The conforming station would receive interference from a non-conforming station in excess of the levels specified in this section; and

(2) The interference would be eliminated if the non-conforming equipment were replaced with equipment which complies with the standards of this subpart, the licensee (or prospective licensee) of the station which would receive interference must provide written notice of the potential interference to both the non-conforming licensee and the Commission's office in Gettysburg, PA. The non-conforming licensee must make all required equipment changes within 180 days from the date of official Commission notice informing the licensee that it must upgrade its equipment, unless an alternative solution has been agreed to by all parties involved in the interference situation. If a non-conforming licensee fails to make all required changes within the

specified period of time, the Commission may require the licensee to suspend operation until the changes are completed.

(e) *Interference dispute resolution procedures.* Should a licensee licensed under this part receive harmful interference from another licensee licensed under this chapter, the parties involved shall comply with the dispute resolution procedures set forth herein:

(1) The licensee experiencing the harmful interference shall notify the licensee believed to be causing the harmful interference and shall supply information describing its problem and supporting its claim;

(2) Upon receipt of the harmful interference notice, the licensee alleged to be causing the harmful interference shall respond immediately and make every reasonable effort to identify and resolve the conflict; and

(3) Licensees are encouraged to resolve the harmful interference prior to contacting the Commission.

[61 FR 26677, May 28, 1996, as amended at 63 FR 68983, Dec. 14, 1998; 65 FR 17449, Apr. 3, 2000; 65 FR 38329, June 20, 2000; 65 FR 59358, Oct. 5, 2000; 66 FR 35110, July 3, 2001; 67 FR 43038, June 28, 2002; 69 FR 31746, June 7, 2004; 70 FR 29996, May 25, 2005]

**§ 101.107 Frequency tolerance.**

(a) The carrier frequency of each transmitter authorized in these services must be maintained within the following percentage of the reference frequency except as otherwise provided in paragraph (b) of this section or in the applicable subpart of this part (unless otherwise specified in the instrument of station authorization the reference frequency will be deemed to be the assigned frequency):

Frequency (MHz)	Frequency tolerance (percent)
928 to 929 <sup>5</sup>	0.0005
932 to 932.5	0.00015
932.5 to 935	0.00025
941 to 941.5	0.00015
941.5 to 944	0.00025
952 to 960 <sup>5</sup>	0.0005
1,850 to 1,990	0.002
2,110 to 2,200	0.001
2,450 to 2,500 <sup>1</sup>	0.001
3,700 to 4,200 <sup>1</sup>	0.005
5,925 to 6,875 <sup>1</sup>	0.005
10,550 to 11,700 <sup>1,2</sup>	0.005
11,700 to 12,200 <sup>1</sup>	0.005
12,200 to 13,250 <sup>4</sup>	0.005

Frequency (MHz)	Frequency tolerance (percent)
14,200 to 14,400	0.03
17,700 to 18,820 <sup>3</sup>	0.003
18,820 to 18,920 <sup>3</sup>	0.001
928 to 929 <sup>5</sup>	0.0005
18,920 to 19,700 <sup>3</sup>	0.003
19,700 to 27,500 <sup>4,7</sup>	0.001
27,500 to 28,350	0.001
29,100 to 29,250	0.001
31,000 to 31,300 <sup>6</sup>	0.001
31,300 to 40,000 <sup>4</sup>	0.03
71,000 to 76,000 <sup>8</sup>	
81,000 to 86,000 <sup>8</sup>	
92,000 to 95,000 <sup>8</sup>	

<sup>1</sup>Applicable only to common carrier LTTS stations. Tolerance for 2450–2500 MHz is 0.005%. Beginning Aug. 9, 1975, this tolerance will govern the marketing of LTTS equipment and the issuance of all such authorizations for new radio equipment. Until that date new equipment may be authorized with a frequency tolerance of .03% in the frequency range 2,200 to 10,500 MHz and .05% in the range 10,500 MHz to 12,200 MHz, and equipment so authorized may continue to be used for its life provided that it does not cause interference to the operation of any other licensee. Beginning March 1, 2005, new LTTS operators will not be licensed and existing LTTS licensees will not be renewed in the 11.7–12.2 GHz band.

<sup>2</sup>See subpart G of this part for the stability requirements for transmitters used in the Digital Electronic Message Service.

<sup>3</sup>Existing type accepted equipment with a frequency tolerance of ±0.03% may be marketed until December 1, 1988. Equipment installed and operated prior to December 1, 1988 may continue to operate after that date with a minimum frequency tolerance of ±0.03%. However, the replacement of equipment requires that the current tolerance be met.

<sup>4</sup>Applicable to private operational fixed point-to-point microwave and stations providing MVDDS.

<sup>5</sup>For private operational fixed point-to-point microwave systems, with a channel greater than or equal to 50 KHz bandwidth, ±0.0005%; for multiple address master stations, regardless of bandwidth, ±0.00015%; for multiple address remote stations with 12.5 KHz bandwidths, ±0.00015%; for multiple address remote stations with channels greater than 12.5 KHz bandwidth, ±0.0005%.

<sup>6</sup>For stations authorized prior to March 11, 1997, transmitter tolerance shall not exceed 0.03%.

<sup>7</sup>The frequency tolerance for stations authorized on or before April 1, 2005 is 0.03%. Existing licensees and pending applicants on that date may continue to operate after that date with a frequency tolerance of 0.03%, provided that it does not cause harmful interference to the operation of any other licensee. For analog systems, if the channel bandwidth is greater than 30 MHz up to 50 MHz, the frequency tolerance standard will be 0.03%; if the channel bandwidth is 30 MHz or less, then the frequency tolerance standard will be 0.003%. This analog standard is conditional provided that harmful interference is not caused to digital stations operating within the 0.001% tolerance standards. If harmful interference is caused to stations operating with the more stringent standard, the onus shall be on the operators with the less stringent parameters to develop an engineering solution to the problem. For exceptions, see § 101.147 and § 101.507.

<sup>8</sup>Equipment authorized to be operated in the 71,000–76,000 MHz, 81,000–86,000 MHz, 92,000–94,000 MHz and 94,100–95,000 MHz bands is exempt from the frequency tolerance requirement noted in the table of paragraph (a) of this section.

(b) Heterodyne microwave radio systems may be authorized at a somewhat less restrictive frequency tolerance (up to .01 percent) to compensate for frequency shift caused by numerous repeaters between base band signal insertion. Where such relaxation is sought, applicant must provide all calculations and indicate the desired tolerance over